FINAL SCOPING REPORT

ALLEN MARTIN DRIVE AND VT-15 INTERSECTION SCOPING STUDY

RSG
the science of insight

4.21.2017

PREPARED FOR:
TOWN OF ESSEX
CHITTENDEN COUNTY REGIONAL PLANNING COMMISSION

SUBMITTED BY:
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COMPLETE STREETS

The CCRPC, in collaboration with its member municipalities, state and local partners, has historically taken a multimodal approach to transportation planning. The Vermont Legislature sought to further encourage these best practices with the passing of Complete Streets Legislation (Act 34) which became effective on July 1, 2011. Its purpose is to ensure that the needs of all transportation users, regardless of their age, ability or preferred mode of transportation, be considered in all transportation projects. By developing a range of alternatives that would improve conditions for walkers and bicyclists, this project is in compliance with the Complete Streets Legislation. **Appendix K** contains a copy of the Complete Streets reporting form for this project.

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1.0 INTRODUCTION

The Town of Essex and Chittenden County Regional Planning Commission (CCRPC) have contracted with RSG to conduct an intersection scoping study of VT Route 15 and Allen Martin Drive. This scoping report compiles the findings of the existing conditions assessment and alternatives analysis, documents the outcome of the public meetings, and presents a preferred alternative and next steps.

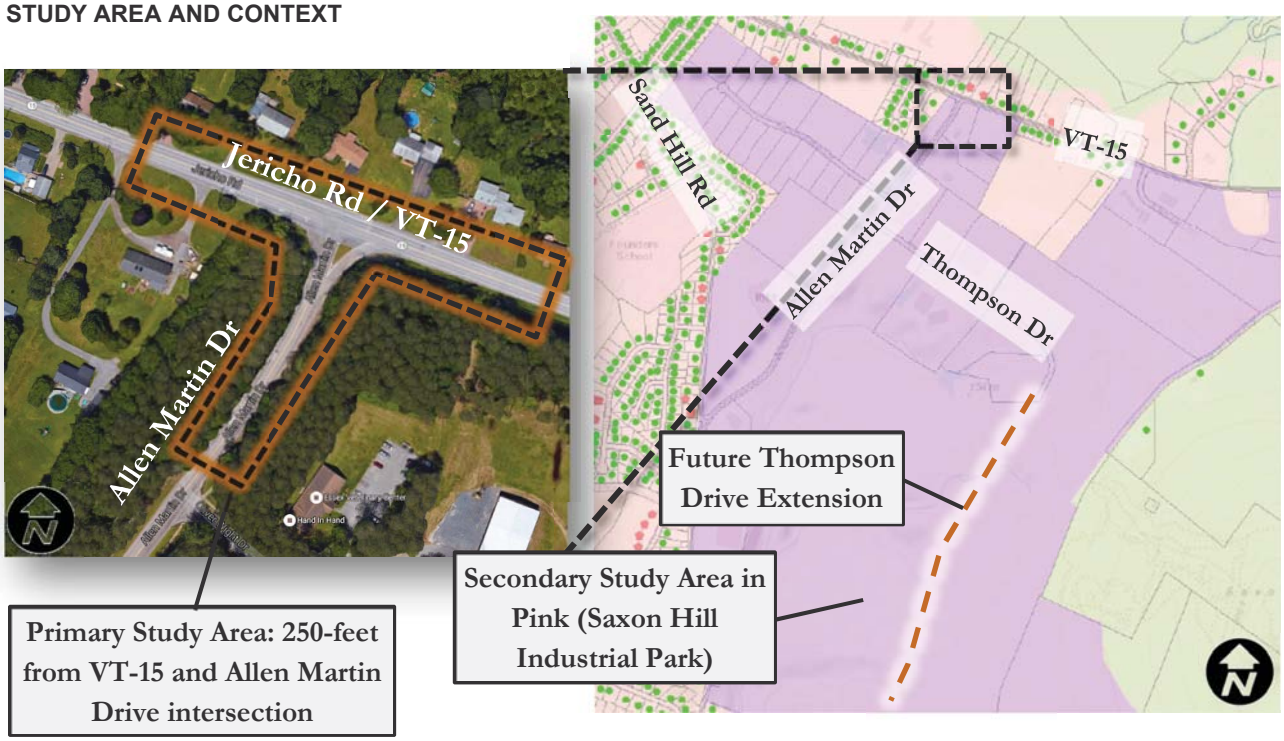
Allen Martin Drive serves as the primary access to the Saxon Hill Industrial Park (SHIP). Continued development in the park has led to a concern of traffic congestion and left turn conflicts at the VT-15 and Allen Martin Drive intersection. Ultimate SHIP plans may include a secondary access road to River Road / VT-117, but until this road is constructed, Allen Martin Drive is expected to remain the primary vehicle access route to the SHIP.

PROJECT DESCRIPTION

The focus of this study is the T-shaped intersection of Allen Martin Drive and VT-15 / Jericho Road, in Essex, Vermont. The Saxon Hill Industrial Park (SHIP) lies on either side of Allen Martin Drive. The primary study area includes 250 feet from this intersection along each direction of VT-15 and Allen Martin Drive. The secondary study area considers the entire SHIP.

The primary and secondary study areas are shown below.

STUDY AREA AND CONTEXT



PURPOSE AND NEED STATEMENT

The purpose and need statement was developed based on a preliminary review of the study area and concerns articulated at the Local Concerns Meeting held on June 7, 2016.

Purpose

The purpose of this project is to ensure that all travelers, including vehicles, freight, pedestrians, and bicyclists can travel safely and efficiently through the Allen Martin Drive / VT-15 intersection, now and in the future.

Need

The need for the project is documented by the following issues:

- There have been no changes to the immediate surrounding road network as businesses have developed within the SHIP;
- There are approximately 200 acres of remaining developable land in the SHIP;
- Recent traffic impact studies for developments within the SHIP indicate that as of 2016 (with those developments in place), the Allen Martin Drive intersection operates at an LOS F and E for northbound vehicles in the AM and PM peak hours, respectively;
- The 2008 Route 15 Corridor Study did not review the intersection and therefore did not recommend any improvements at the intersection;
- Residents have cited concern with the speed of vehicles traveling on VT-15 affecting the safety and livability of the area around the intersection, particularly when crossing the street on foot;
- The SHIP includes a trail network for walking and bicycling opportunities into the future, indicating higher bicycle and pedestrian volumes may be present; and
- Changes to the planned regional transportation network have indicated that Allen Martin Drive may serve as an important bypass route in the future.

PROJECT PROCESS

The project primarily focused on three analyses, summarized in this report:

- Existing Conditions Analysis
- Future Traffic Conditions Analysis
- Alternatives Analysis

Public input was gathered during two **public meetings**:

- Local Concerns Meeting (June 8, 2016 at the Fire Station in Essex)
- Alternatives Presentation Meeting (December 19, 2016 at the Essex Town Offices)

Notes from these meetings are included as an attachment to this report.

2.0 PROJECT AREA EXISTING CONDITIONS

LAND USE

The Allen Martin Drive / VT-15 intersection is bounded by residential, industrial, and other business-related land uses (Figure 1). There are five driveways for houses within the primary study area; four of these are on the north side of VT-15 and one is on the south side of VT-15, to the west of Allen Martin Drive. Two of the houses are multi-family and one is single-family.

To the south of the intersection, the land use is dominated by the Saxon Hill Industrial Park (SHIP). The SHIP is primarily industrial and commercial land use, with a network of trails through the undeveloped wooded terrain for bicycle and pedestrian use. This network will remain as the SHIP continues to develop.

FIGURE 1: LAND USE (CCRPC ECOS VIEWER)

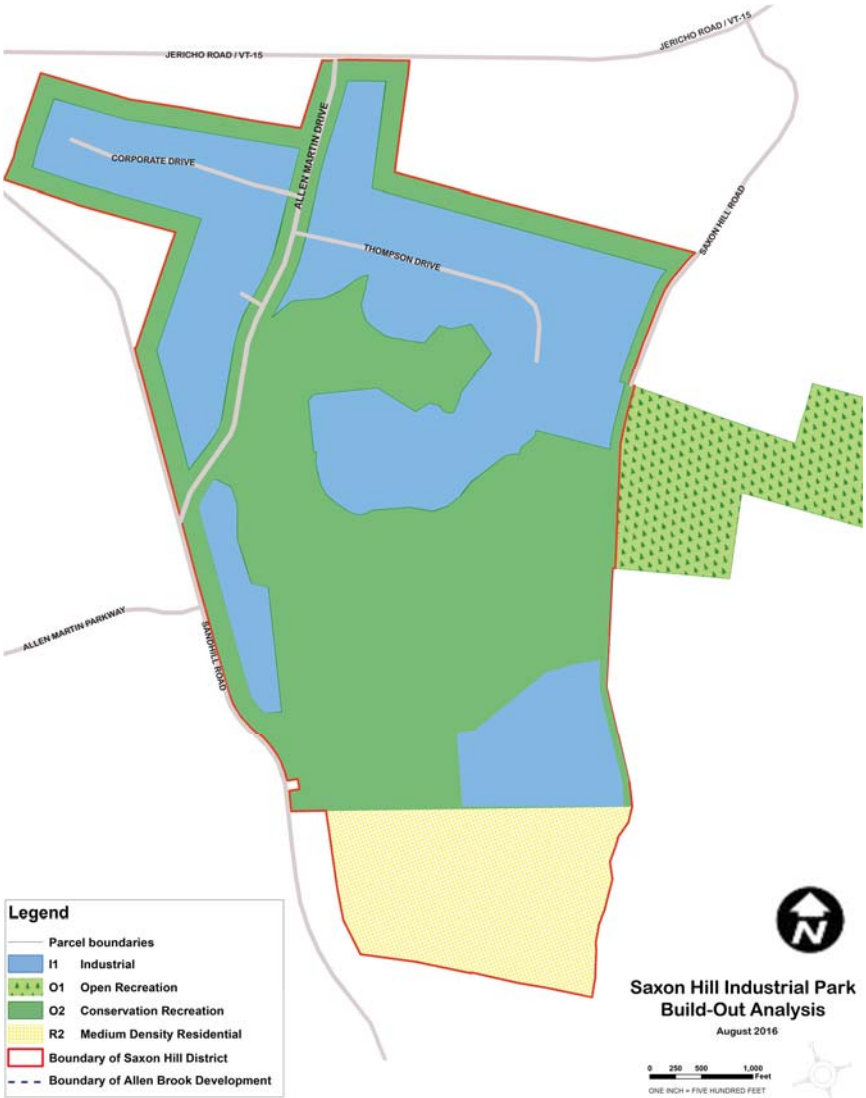
SHIP BUILD-OUT POTENTIAL

The Town of Essex has designated the Saxon Hill Industrial Park (SHIP) as a Resource Preservation District – Industrial (RPD-I) zoning district. In an RPD-I district, 40% of the land can be developed for industrial/commercial purposes, and the remaining 60% of the land must be preserved as undeveloped open space. A 200-foot buffer is required between industrial uses and residential parcels. This buffer as well as the mountain biking trails in the SHIP are included in the 60% conservation land.

The land in the SHIP has either already been developed or has been designated for one of the two uses - Industrial or Conservation/Recreation. Of the lots designated for industrial purposes, approximately 250 acres are currently undeveloped, including around 50 acres of residential buffer. A temporary no-build easement of 27.5 acres is not included in this area.

Figure 2 illustrates the designated uses of areas within the SHIP.

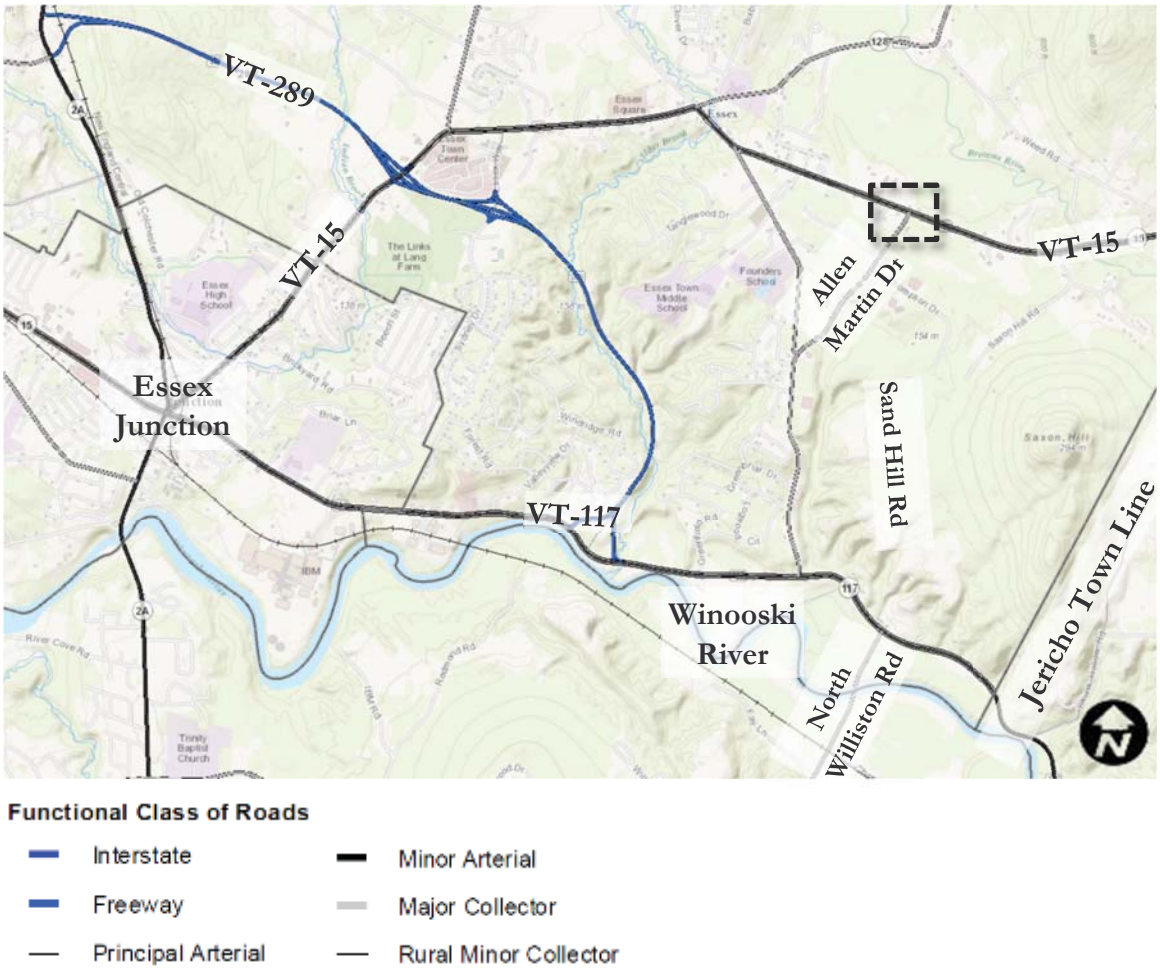
FIGURE 2: SAXON HILL ZONING MAP



ROADWAY CLASSIFICATION AND CIRCULATION

Allen Martin Drive and Sand Hill Road are both Class 2 Town Highways and Federal Aid Urban Streets, further classified as major collectors (Figure 3). VT-15 and VT-117 are both state highways and minor arterials on the National Highway System with access to VT-289 and the Village of Essex Junction to the west and the Town of Jericho to the east. Approximately 0.5 miles southeast of Sand Hill Road along VT-117 is North Williston Road, a Class 2 Town Highway. South of VT-117 along North Williston Road is a regionally significant bridge over the Winooski River. Another 4.5 miles southeast along VT-117 from North Williston Road lies the US-2 intersection and Exit 11 of I-89 in Richmond.

FIGURE 3: FUNCTIONAL CLASSIFICATION (CCRPC ECOS VIEWER)



Corporate Drive and Thompson Drive are both dead end Class 3 Town Highways wholly located within the Saxon Hill Industrial Park serving the commercial and industrial land uses.

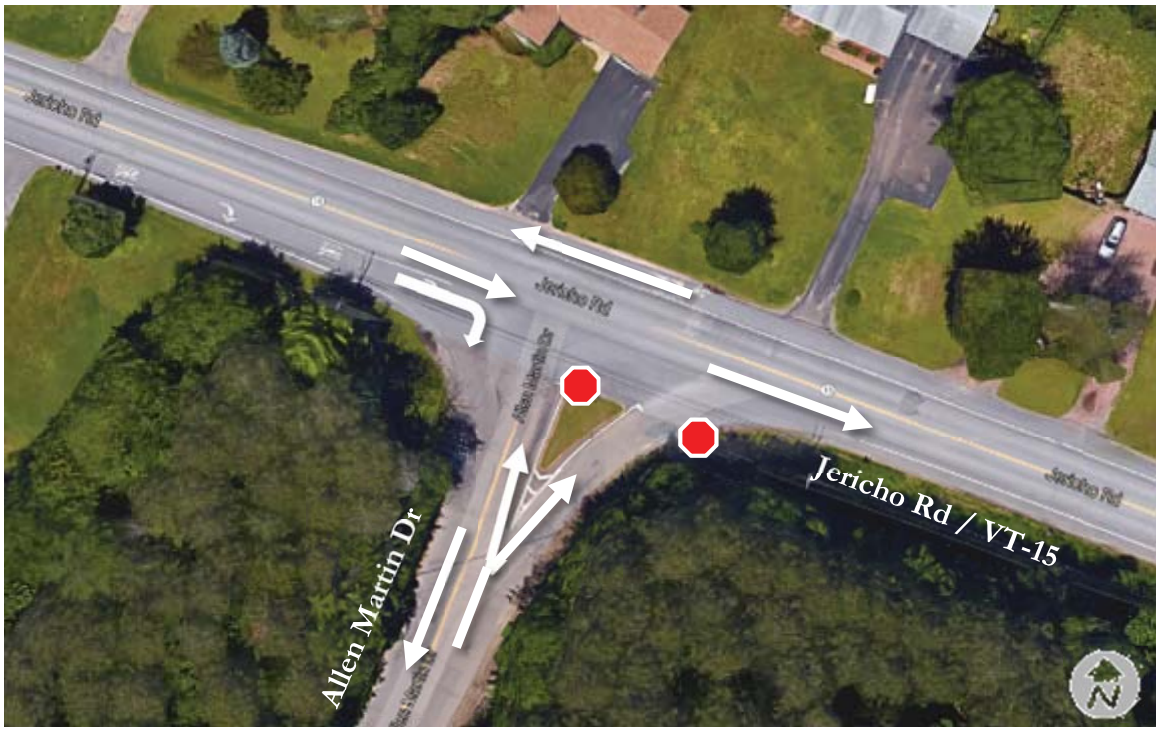
At Allen Martin Drive, VT-15 has a speed limit of 40 mph and an average annual daily traffic (AADT) of 10,900 vehicles per day as estimated at automatic traffic recorder (ATR) station D121 in 2013. Allen Martin Drive has a speed limit of 35 mph and an AADT of 2,500 vehicles per day as estimated at ATR station D548 in 2013.

INTERSECTION GEOMETRY AND TRAFFIC CONTROL

VTrans District 5 was contacted for documentation of the Right-of-Way (ROW). Records from a 1933 construction project in this area indicate the ROW to be 49.5 feet wide. The document appears to show the highway right-of-way shifted to the south, but in the years since this document was prepared, the highway has been reconstructed and widened. The ROW should be assumed to be centered on the existing highway centerline.

VT-15 / Jericho Road has one lane in each direction. As it approaches Allen Martin Drive from the west, it also has a right-turn lane and a wide curb for improved truck access onto Allen Martin Drive (Figure 4). Allen Martin Drive has one lane in each direction, with a 60-foot channelized right-turn slip lane. This intersection is stop-controlled, with a stop sign in the median for northbound vehicles turning left onto VT-15, and a stop sign on the east side of the slip lane for northbound vehicles turning right onto VT-15.

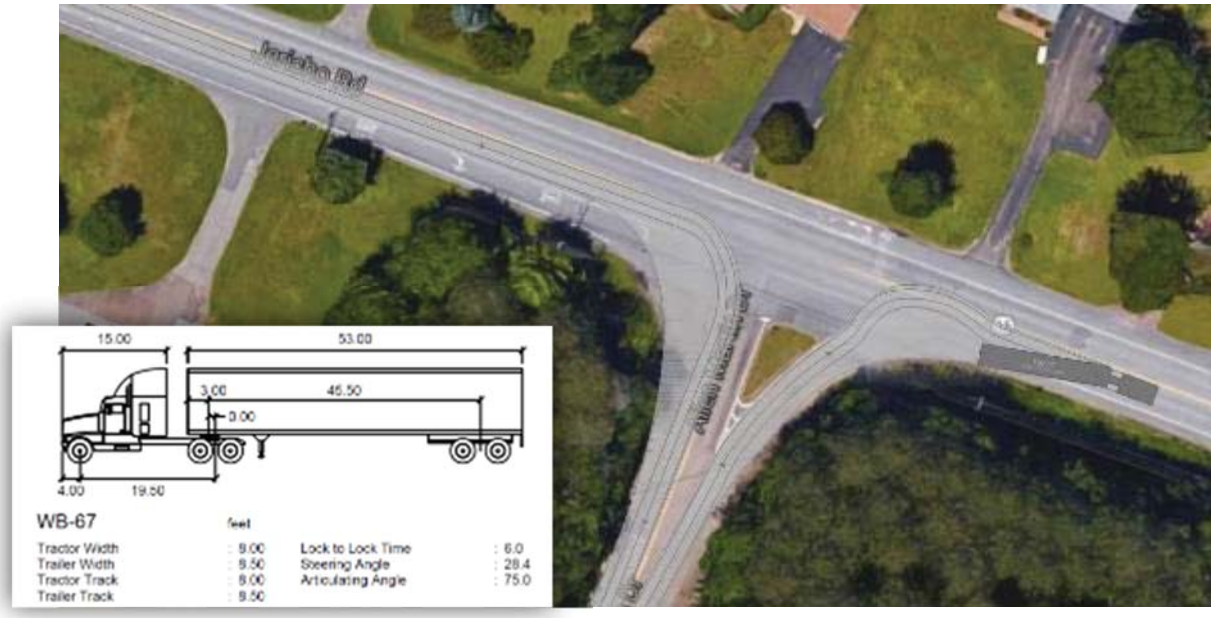
FIGURE 4: INTERSECTION DETAIL



Utility poles are located on the south side of VT-15 and the west side of Allen Martin Drive. There is town water and sewer service throughout the project area.

The turning radius of a WB-67 truck was overlaid on the study area for eastbound right turns onto Allen Martin Drive and northbound right turns onto VT-15 (Figure 5). Trucks turning right onto Allen Martin Drive must use the VT-15 through lane. Trucks turning right onto VT-15 may need to cross slightly into the westbound lane.

FIGURE 5: TRUCK TURNING RADIUS



INTERSECTION SIGHT DISTANCE

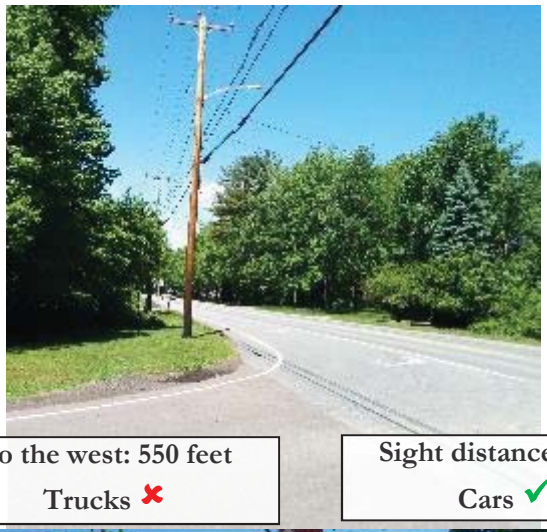
For vehicles on Allen Martin Drive turning east or west onto VT-15, intersection sight distance is limited by utility poles and by a large stand of mixed trees present along both sides of Allen Martin Drive south of VT-15. There are no horizontal or vertical curves in the project area that significantly impact sight distance. Available sight distance is acceptable for passenger cars in both directions but does not meet the necessary threshold for heavy trucks turning eastbound (Figure 7).

During a site visit, it was observed that drivers on Allen Martin Drive turning west creep past the stop bar to get a better view of vehicles on VT-15 (Figure 6). This happens due to the limited sight distance and because of the placement of the stop bar. Best practice is to align stop bars with the through lane, but the stop bar and the front of the island appear to be aligned with the edge of the eastbound VT-15 right turn lane (Figure 8).

FIGURE 6: VEHICLES STOPPING PAST THE STOP BAR

FIGURE 7: INTERSECTION SIGHT DISTANCES

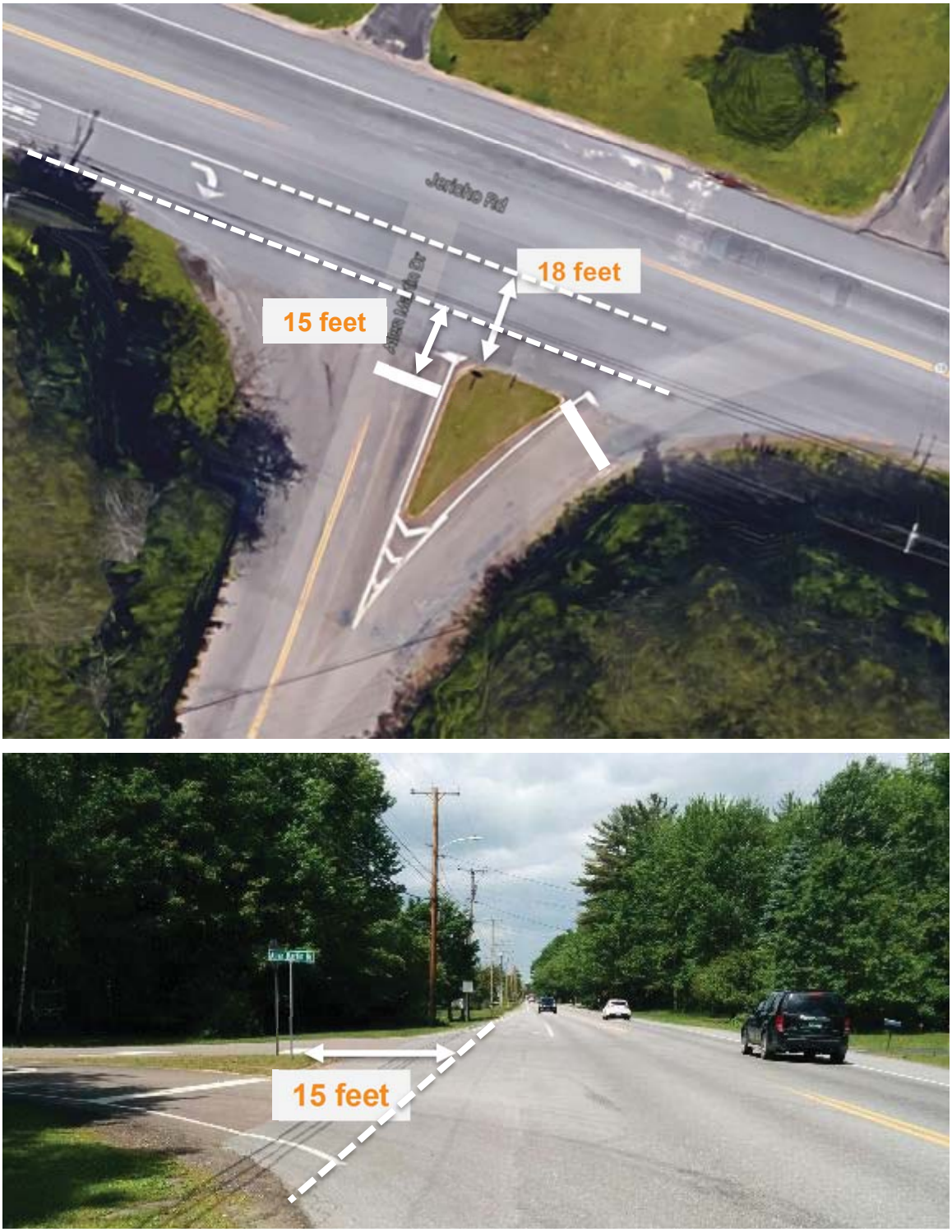
Minimum Required Sight Distance	
Passenger Cars	445 feet
Heavy Trucks	685 feet



Sight distance to the west: 550 feet
Cars ✓ Trucks ✘

Sight distance to the east: 690 feet
Cars ✓ Trucks ~

FIGURE 8: STOP BAR AND ISLAND SETBACK



PEDESTRIAN, BICYCLE, AND TRANSIT CONNECTIVITY

There is an existing sidewalk along the east side of Allen Martin Drive and a sidewalk along the south side of VT-15 between Sandhill Road and Allen Martin Drive (Figure 9). While there are currently no designated bicycle paths or shared-use paths proximate to the study area, there is a proposed shared-use path parallel to the north side of VT-15 and parallel to the east side of Allen Martin Drive. These paths would provide regional connectivity for pedestrians and bicyclists.

Within the SHIP, a sidewalk runs along the south side of Thompson Drive and stops at the east end of the Reinhart Food Service development. A sidewalk also runs along the south side of Corporate Drive.

The closest transit access to the study area is via the Green Mountain Transit (GMT, formerly CCTA) Route 4 Essex Center bus, which runs along Sandhill Road, making local stops (Figure 10). The GMT Route 36 Jefferson Commuter bus runs along VT-15; the closest stop to the study area this bus makes is at the Essex Outlets.

FIGURE 9: PEDESTRIAN AND BICYCLE CONNECTIVITY (ECOS VIEWER)

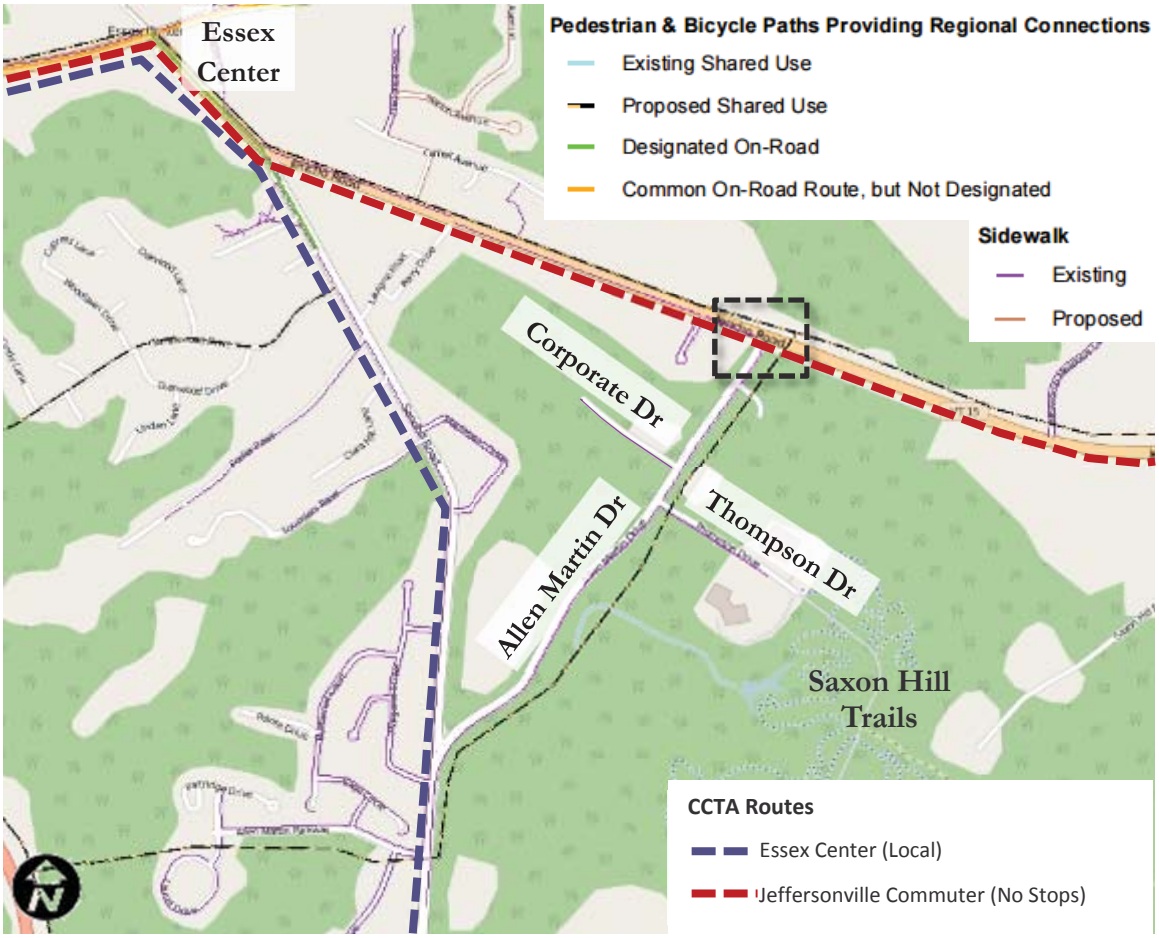
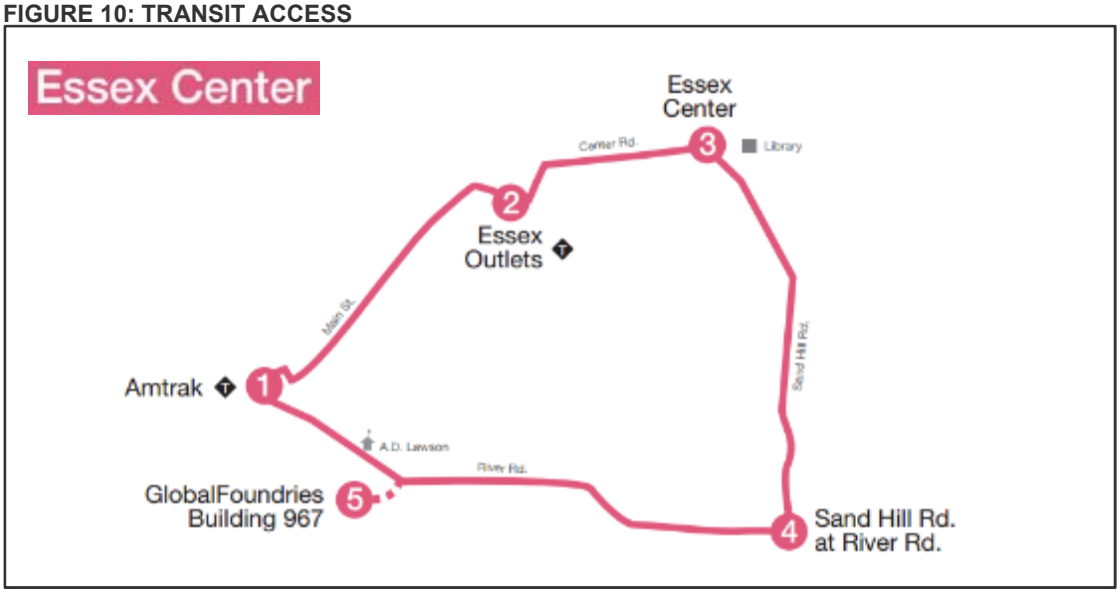
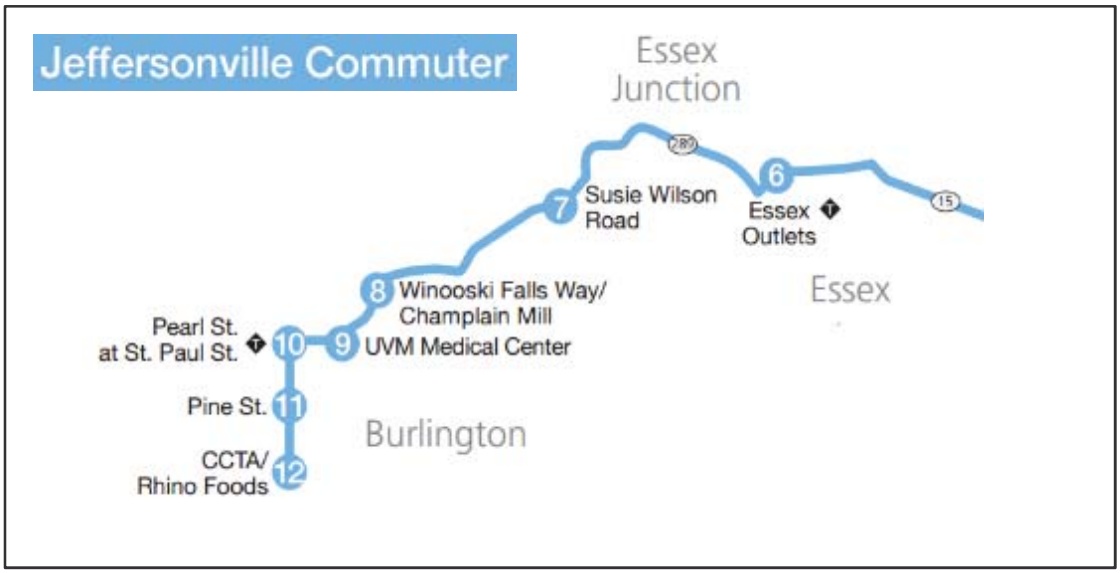


FIGURE 10: TRANSIT ACCESS





CRASH HISTORY

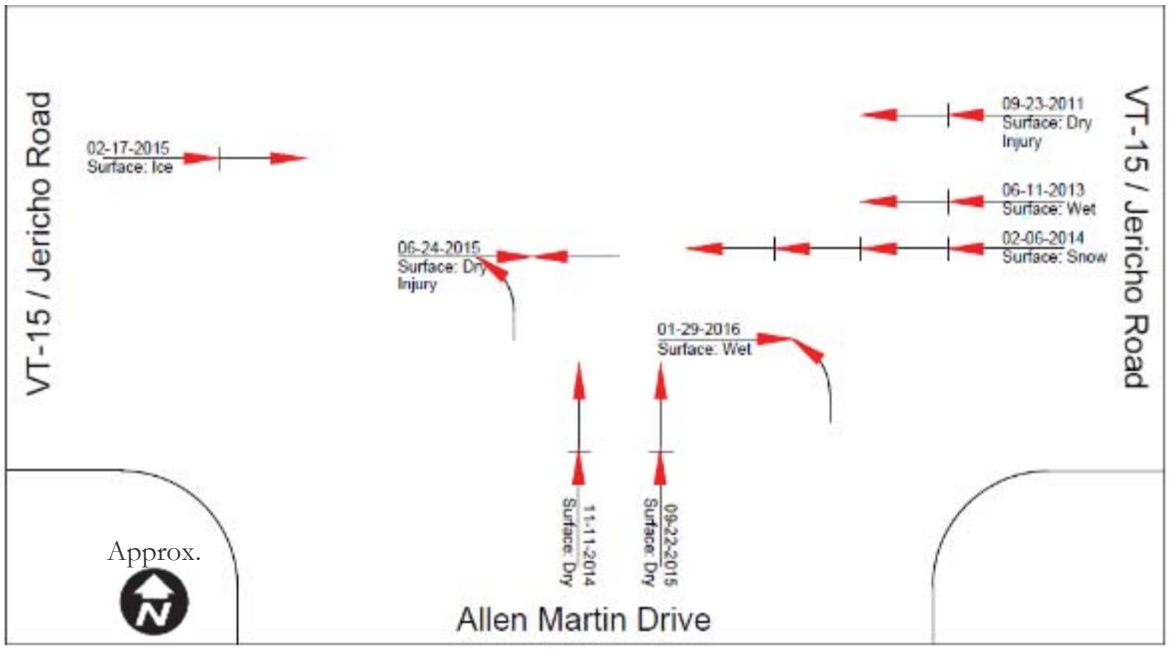
In the past five years (between May 1, 2011 and May 1, 2016), eight crashes were reported within the primary study area (Table 1 and Figure 11). These crashes include six rear ends and two broadsides. Two crashes resulted in injury. There were no alcohol or drugs indicated, no pedestrians, bicycles, or motorcycles involved, and no animals involved in any of the crashes. Most of these crashes occurred during daylight, but with varying road surface conditions. Based on crash reports obtained from VTrans, two crashes appear to be primarily due to slippery road surface conditions, and the remaining six crashes appear to be primarily due to driver error.

The six rear end crashes compose 75% of all the crashes in the past five years. Three of these crashes occurred on the westbound approach. Rear end crashes are typically indicative of variable speed traffic sharing the same lane.

TABLE 1: CRASHES IN THE PRIMARY STUDY AREA, MAY 2011-MAY 2016

Date	Damage / Injury	Road Surface Condition	Type of Collision
01/29/16	Property Damage Only	Wet	Angle Broadside; NB-L and EB-T
09/22/15	Property Damage Only	Dry	Rear End; NB
06/24/15	Injury	Dry	Broadside; NB-L, EB-T, and WB-T
02/17/15	Property Damage Only	Ice	Rear End; EB
11/11/14	Property Damage Only	Dry	Rear End; NB
02/06/14	Property Damage Only	Snow	Rear End; WB; 4 cars
06/11/13	Property Damage Only	Wet	Rear End; WB
09/23/11	Injury	Dry	Rear End; WB

FIGURE 11: COLLISION DIAGRAM IN THE PRIMARY STUDY AREA, MAY 2011-MAY 2016



Data: May 2011 - May 2016

At the June 8, 2016 local concerns meeting, residents reported a recent westbound multi-car rear end crash not reflected in this data.

There have also been six crashes reported along Allen Martin Drive during the same time period. None of these resulted in injury (Figure 12).

There are no High Crash Locations proximate to the study area.

FIGURE 12: CRASH HISTORY AT ALLEN MARTIN DRIVE / VT-15 INTERSECTION

NATURAL RESOURCES

There are no significant natural resource concerns within the primary area, but the secondary study area does include resources of note. The secondary study area includes several small bodies of water, streams and/or wetlands (Figure 13) and a moderate to high concentration of biodiversity (Figure 14). Within and around the wetlands are a higher concentration of biodiversity.

Among the natural resources investigated that were not present within the study area were rare, threatened, and endangered species; significant natural communities; and deer wintering areas. The nearest major body of water is Browns River, the closest part of which is located 1,500 feet northeast of the VT-15 and Allen Martin Drive intersection.

FIGURE 13: WATER BODIES (ANR NATURAL RESOURCES ATLAS)

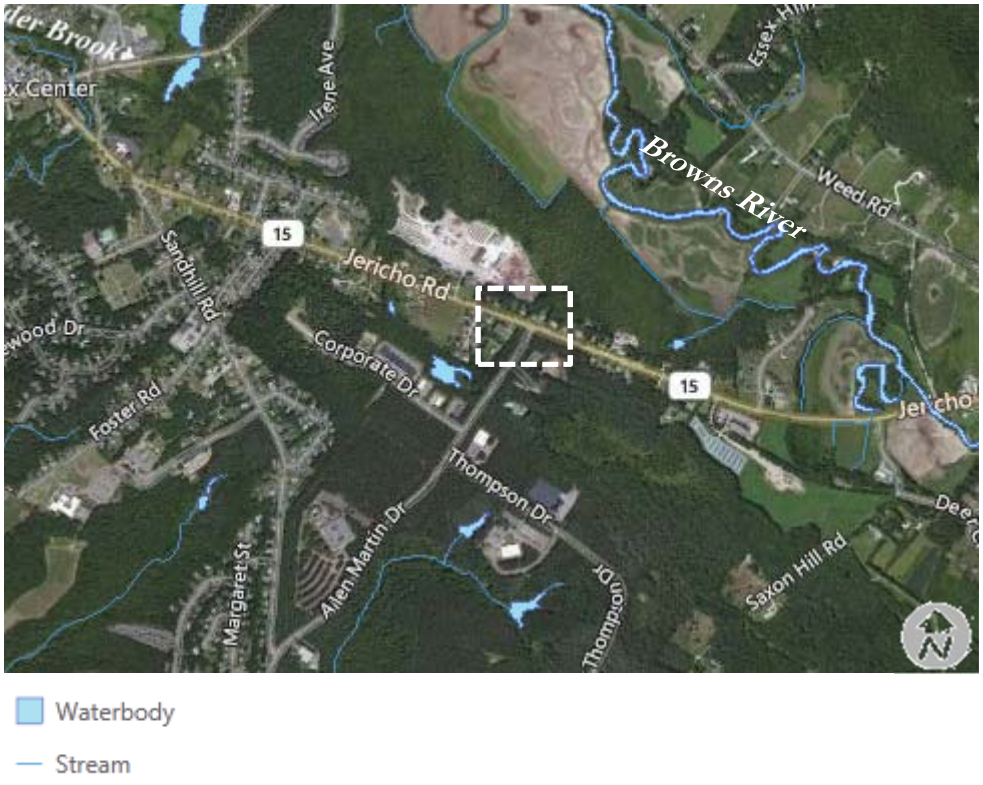
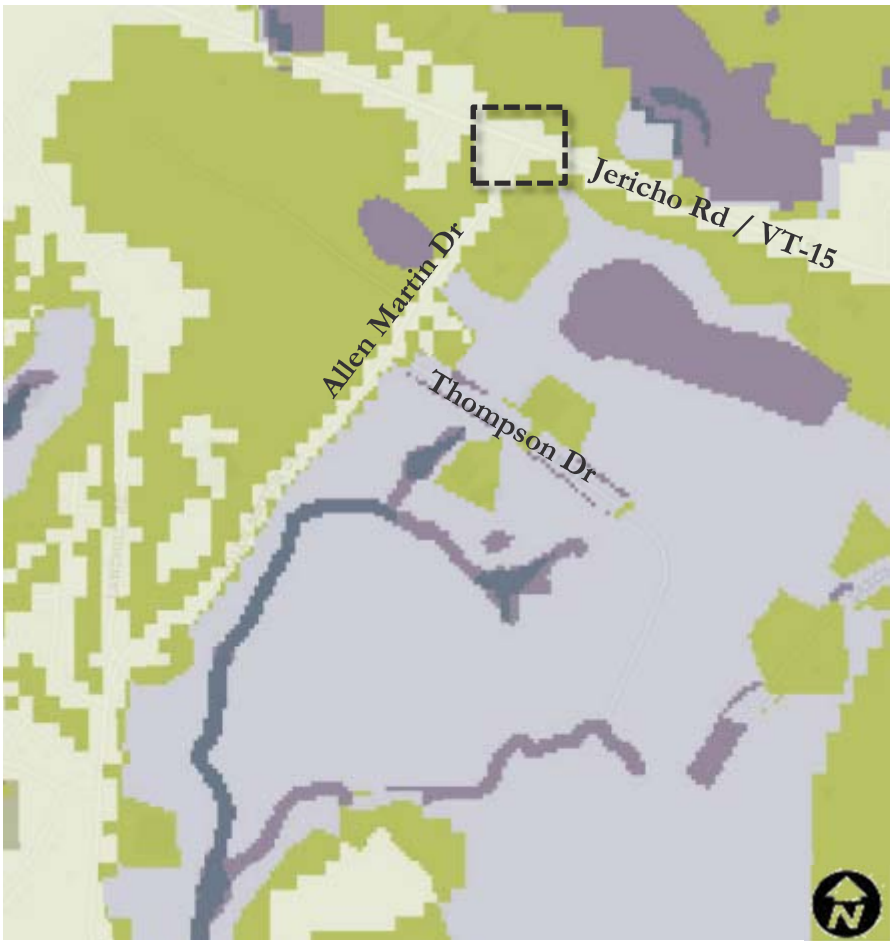


FIGURE 14: TIERED CONTRIBUTION TO BIODIVERSITY (ANR NATURAL RESOURCES ATLAS)



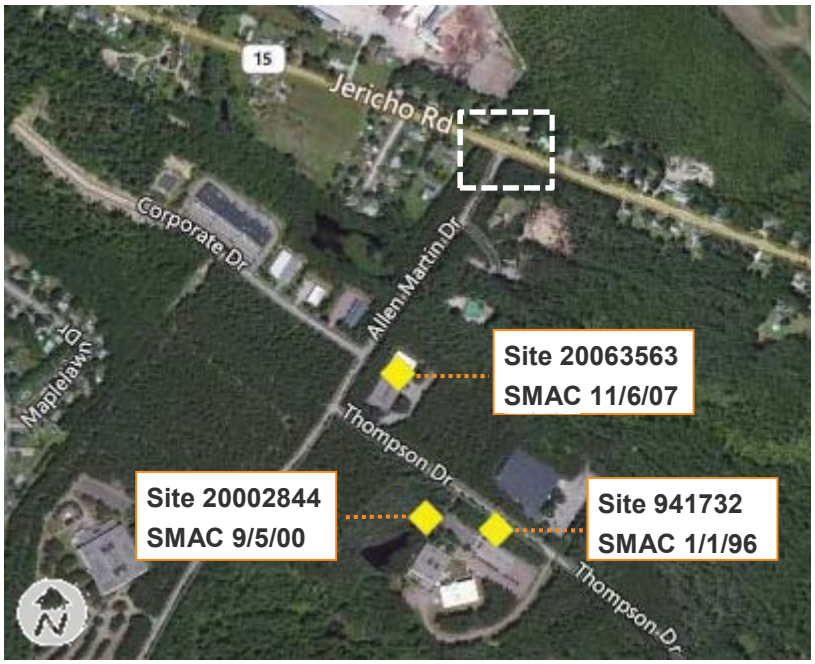
Component Concentration

- Tier 1 = Greatest
- Tier 2 = Very High
- Tier 3 = High
- Tier 4 = Moderate
- Tier 5 = Low
- Tier 6 = Insufficient Data

HAZARDOUS SITES

There are three hazardous sites in the Saxon Hill Industrial Park, all three of which have been remediated. They are identified in Figure 15 by site number according to the Vermont Agency of Natural Resources Waste Management Database.

FIGURE 15: HAZARDOUS SITES (ANR NATURAL RESOURCES ATLAS)



Hazardous Site

SMAC = Site management activity completed

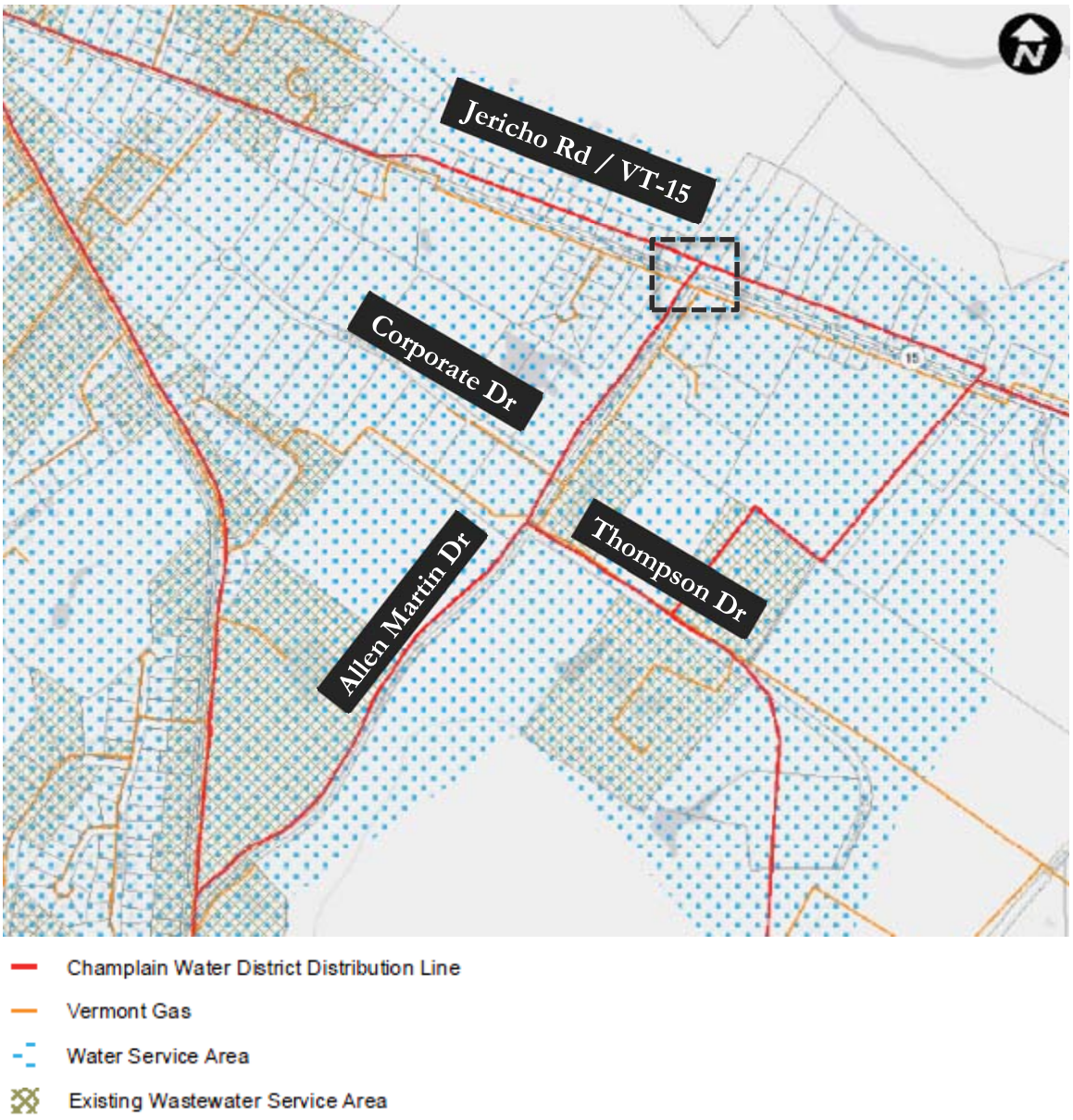
HISTORICAL AND ARCHAEOLOGICAL SITES

There are no known historical sites in the study area according to the Vermont Agency of Natural Resources (ANR) Natural Resource Atlas. The Allen Brook Development plan identifies archaeological area VT.CH.1043 within the Saxon Hill Industrial Park.

UTILITIES

There are several existing utilities in the study area (Figure 16), including Vermont Gas lines and Champlain Water District lines. The entire study area is within a water service area and several areas of it are within a wastewater service area.

FIGURE 16: UTILITIES (CCRPC ECOS VIEWER)



3.0 TRAFFIC DATA COLLECTION

PREVIOUS STUDIES

Recent studies relevant to the study area include a VT-15 corridor study and two traffic impact studies for proposed developments within the Saxon Hill Industrial Park. These are summarized below.

Route 15 Corridor Study (August 2008): This study addresses existing conditions and future conditions of VT-15 and offers implementation strategies related to roads, transit, bicycle and pedestrian facilities, and land use. It studies a number of intersections along VT-15 between Winooski and the Essex-Jericho town line, including Sand Hill Road (approximately 4,800 feet from Allen Martin Drive) but not the Allen Martin Drive intersection itself. The study identified VT-15's AADT between Sand Hill Road and the town line of Jericho to be 11,000 vehicles per day in 2005. Truck traffic east of Five Corners in Essex Junction was 3% of the total daily flow in 2005.

Reinhart Food Service Traffic Evaluation (November 2012): This study provides a trip generation and traffic impact assessment for a 125,000 SF warehouse and office for Reinhart Foods off Thompson Drive in the SHIP. Among the intersections included in the project's Traffic Impact Study (TIS) was the intersection of Allen Martin Drive with VT-15. The resulting traffic volumes are presented in the following figures. Note that this study included permitted traffic from the Corporate Drive development "Lot C" within the adjusted volumes. The permitted traffic included 212 AM and 169 PM peak hour trips.

FIGURE 17: 2012 RAW VOLUMES

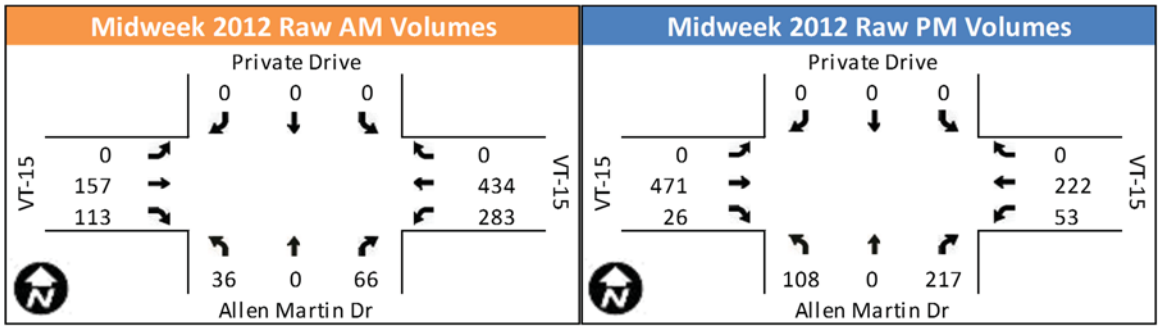


FIGURE 18: 2012 ADJUSTED VOLUMES (INCLUDES LOT C PERMITTED TRAFFIC)

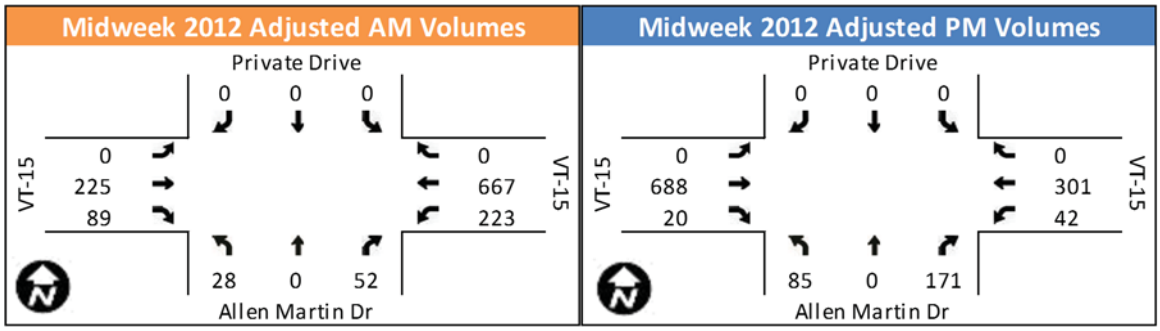
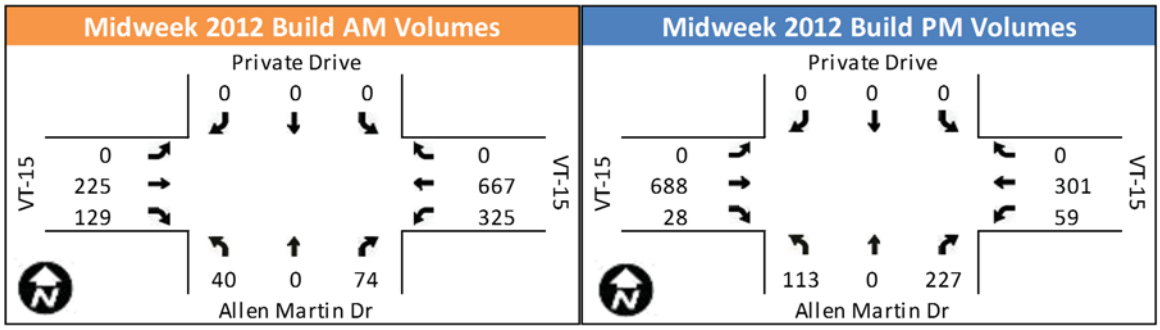


FIGURE 19: 2012 BUILD VOLUMES (INCLUDES EXISTING AND PERMITTED TRAFFIC)



Traffic analysis indicated that the only turns with an unsatisfactory LOS were the northbound left turns, which had an LOS of F in the AM peak and an LOS of E in the PM peak. A traffic signal warrant analysis at this intersection determined that a signal was not warranted, but that a westbound left turn lane was warranted. Trips generated by the new development were not expected to significantly affect this intersection. In addition, a review of intersection sight distance found that there was an adequate sight distance at the Allen Martin Drive intersection with VT- 15.

TABLE 2: 2012 INTERSECTION ANALYSIS DURING PM PEAK HOUR

	NB Left		NB Right	
	No Build	Build	No Build	Build
LOS	E	E	C	C
Delay	37.2	38.6	20.6	21.1

Saxon Hill Corporation Traffic Evaluation (July 2015): This study provides a trip generation and traffic impact assessment for a 14,400 SF warehouse for the Saxon Hill Corporation off of Corporate Drive in the SHIP. This study used a PM traffic count from 2013 and adjusted to 2015, the year of the study. These volumes are shown in the following tables.

FIGURE 20: 2013 RAW VOLUMES

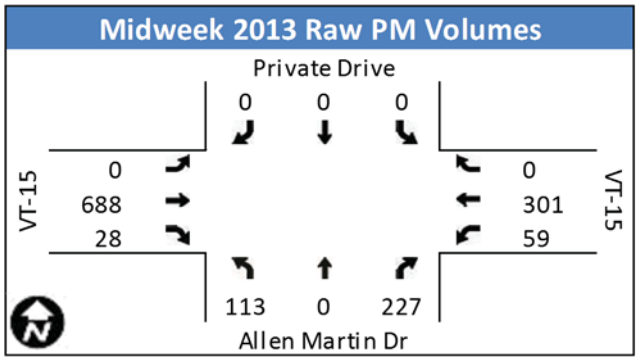


FIGURE 21: 2015 ADJUSTED VOLUMES

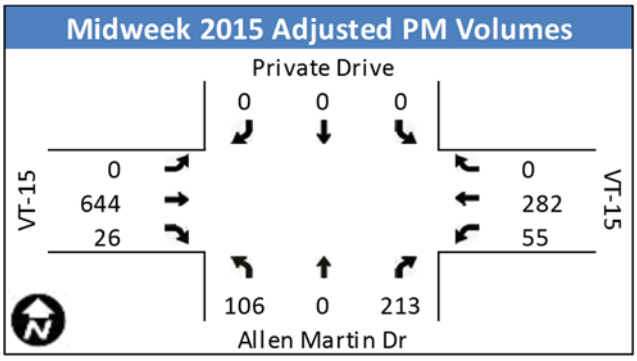
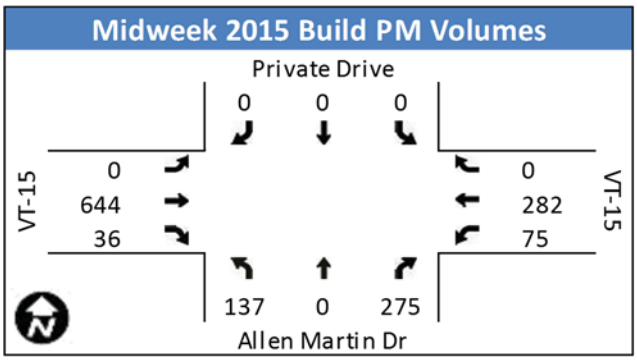


FIGURE 22: 2015 BUILD VOLUMES (INCLUDES EXISTING AND PERMITTED TRAFFIC)



A capacity analysis performed during the PM peak period for the intersection of Allen Martin Drive and VT-15 in 2013 projected LOS and delay in 2015 for a No Build and Build scenario. This analysis determined that the capacity of the No Build scenario was acceptable except for northbound left turns, which had an LOS of E and a delay of 44.2 seconds in the PM peak. However, the new development would only generate one additional trip taking this turn, resulting in no change in the LOS and less than a one second increase of delay.

TABLE 3: 2015 PROJECTED INTERSECTION ANALYSIS DURING PM PEAK HOUR

	NB Left		NB Right	
	No Build	Build	No Build	Build
LOS	E	E	C	C
Delay	44.2	45.1	22.7	22.8

2016 OBSERVED TRAFFIC VOLUMES

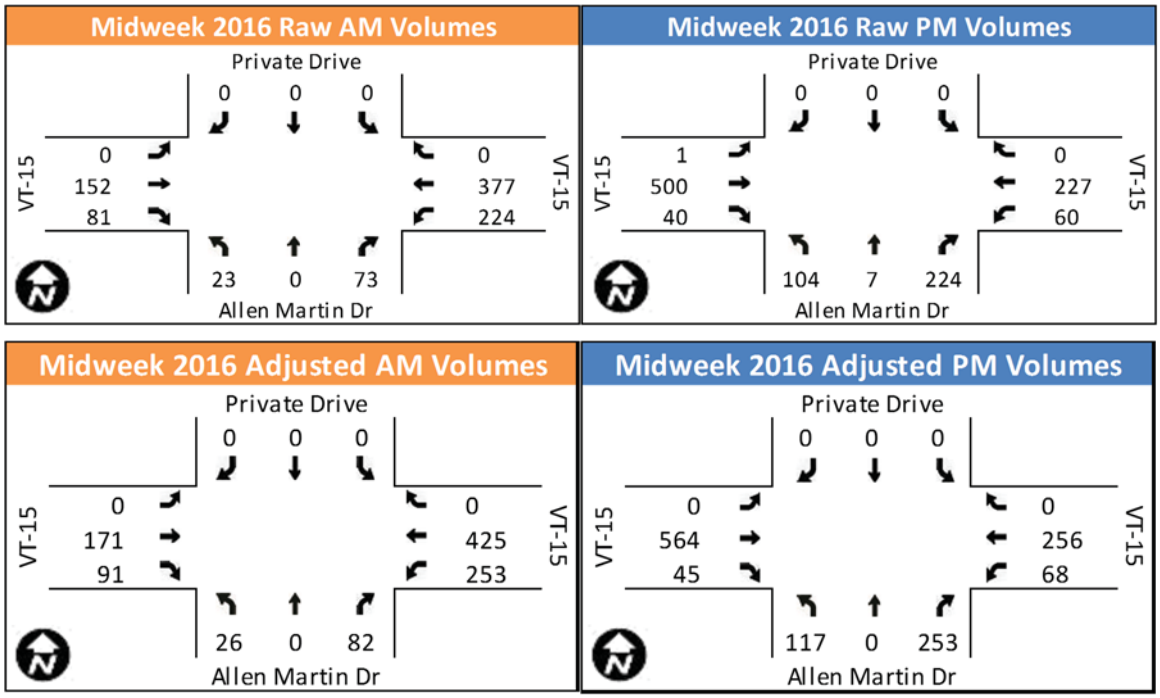
RSG performed a 12-hour turning movement count on April 14, 2016 (6AM to 6PM) at the intersection of VT-15 and Allen Martin Drive. Given that the intersection directly serves the Saxon Hill Industrial Park, truck volumes were expected to be high; trucks were noted to account for 4% of the total AM peak hour traffic volume, and 0.5% of the PM peak hour traffic volume.

Following VTrans traffic study guidelines, observed peak hour traffic volumes were adjusted to represent the design hour volume (DHV)[1]. Design hour adjustment factors are based on VTrans automatic traffic recorder (ATR) D121, located on VT-15 approximately 1.4 miles east of Allen Martin Drive. The calculations to adjust observed traffic volumes to the DHV are as follows:

1. The most recently observed AADT at ATR D121 was 10,900 vehicles in 2013. This AADT was adjusted to 2016 using a growth factor of 0.99, equaling a **2016 estimated AADT** of **10,791 vehicles.**
2. The k factor of VT-15 is 0.1061. Plugging this k factor and the 2016 AADT into the equation DHV = AADT * k leads to a **DHV** of 10,791 * 0.1061 = **1,140 vehicles.**
3. Because ATR D121 is east of the Allen Martin Drive intersection, vehicles in the 2016 Allen Martin Drive / VT-15 traffic count that entered the intersection from the east or exited the intersection heading east were added together. The total number of vehicles from the **peak hour of this count that likely passed ATR D121** are **1,011 vehicles.**
4. The adjustment factor between 1,011 and 1,140 is 1.13. Therefore, the observed traffic volumes at the Allen Martin Drive intersection were **increased by 13%** to adjust to the DHV.

The raw and adjusted volumes are shown in the following figures.

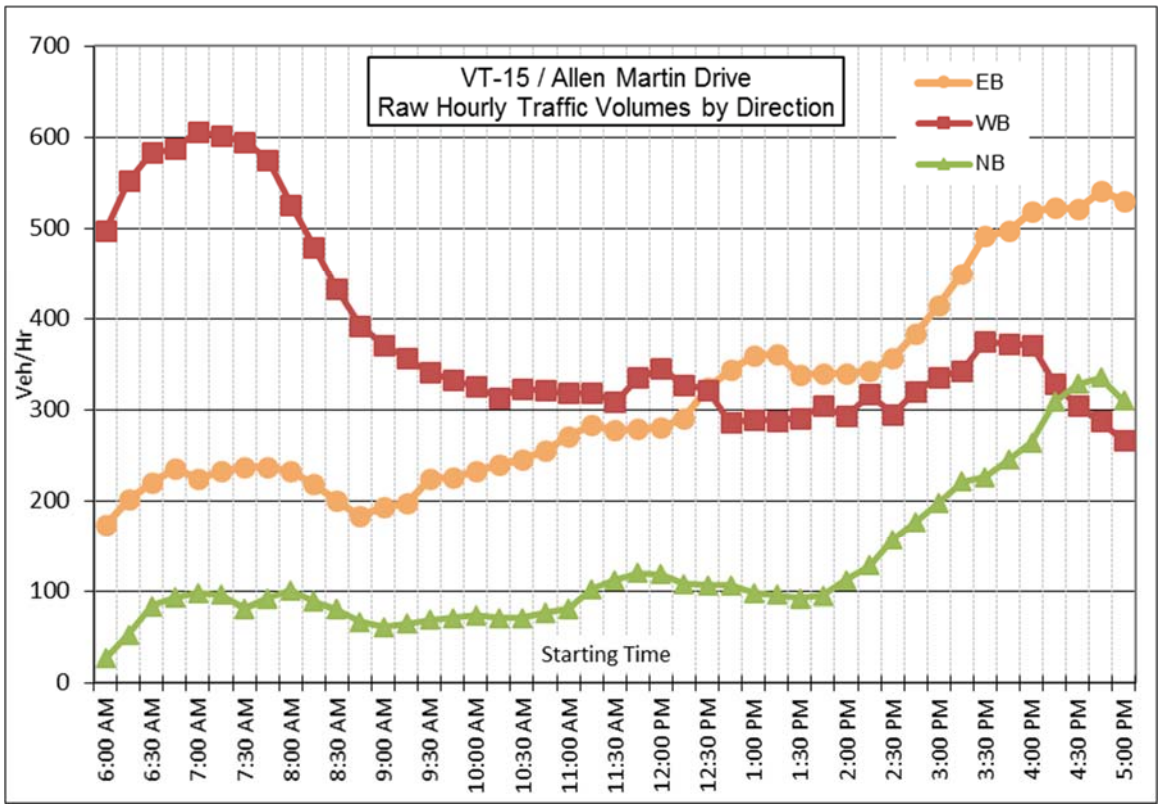
FIGURE 23: 2016 RAW AND ADJUSTED PEAK HOUR VOLUMES



[1] The DHV is the 30th highest hour of traffic for the year and is used as the design standard in Vermont.

The following chart shows hourly traffic volumes by direction. Westbound traffic has a peak in the morning, between 6:00am and 9:00am, and is roughly steady the rest of the day except for a smaller peak between 3:00pm and 4:00pm. Eastbound traffic rises over the course of the day and begins to increase more rapidly at approximately 2:30pm. Northbound traffic is roughly steady throughout the day and begins to increase around 2:30pm, reaching a peak around 4:45pm.

FIGURE 24: 12-HOUR COUNT SUMMARY (RAW VOLUMES)



4.0 TRAFFIC ANALYSIS

Traffic analysis of the intersection shall account for existing traffic volumes, expected regional traffic growth, and continued development of the Saxon Hill Industrial Park.

SHIP BUILDOUT

The Town of Essex has designated the Saxon Hill Industrial Park (SHIP) as a Resource Preservation District – Industrial (RPD-I) zoning district. In an RPD-I district, 40% of the land can be developed for industrial/commercial purposes, and the remaining 60% of the land must be preserved as undeveloped open space. A 200-foot buffer is required between industrial uses and residential parcels. This buffer as well as the mountain biking trails in the SHIP are included in the 60% conservation land.

Within a given parcel, only 60% of the parcel may be developed with an impervious surface. The remaining 40% of the parcel includes the residential buffer, if applicable.

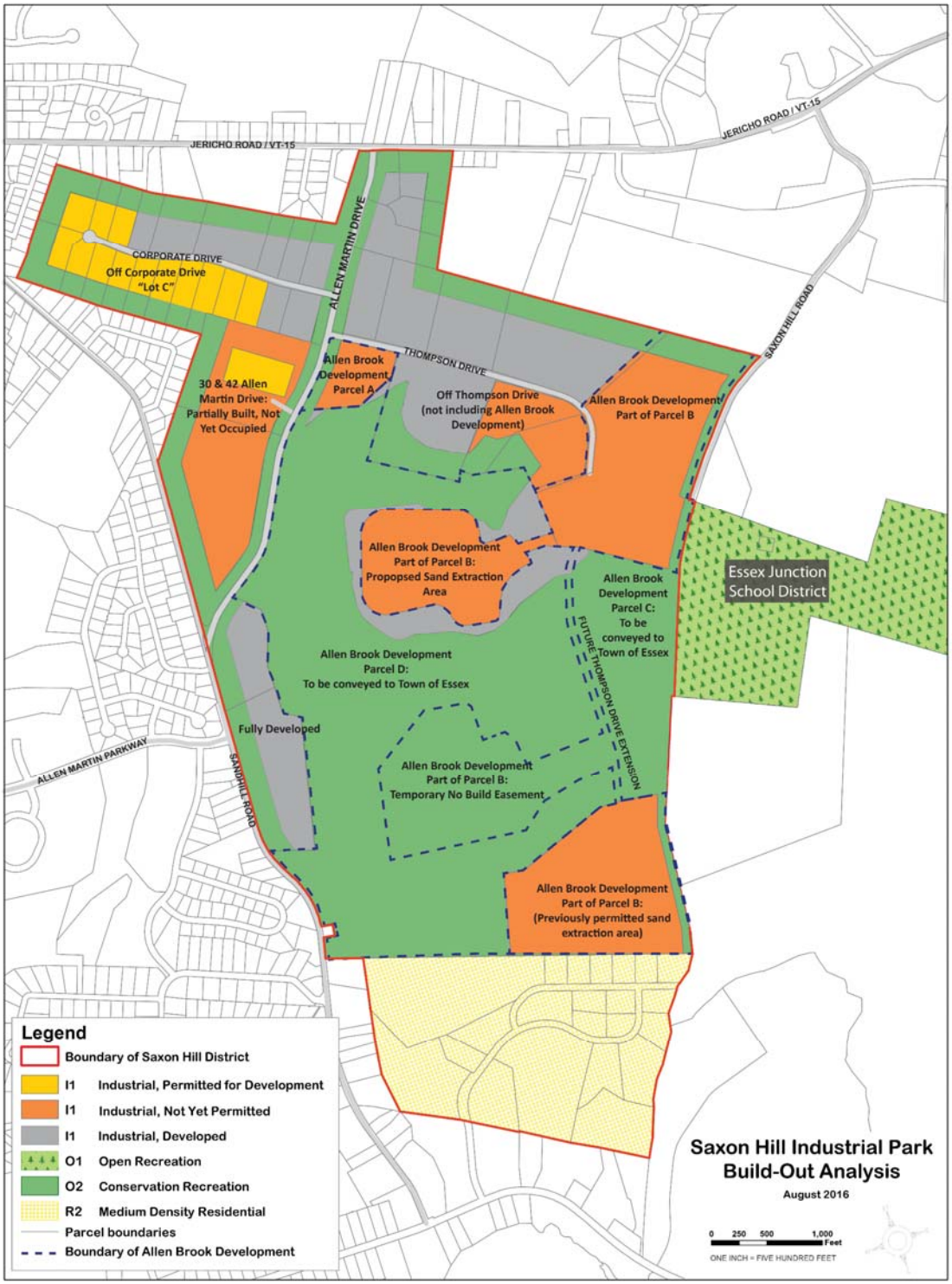
The land in the SHIP has either already been developed or has been designated for one of the two uses - Industrial or Conservation/Recreation. Of the lots designated for industrial purposes, approximately 250 acres are currently undeveloped, including around 50 acres of residential buffer. A temporary no-build easement of 27.5 acres is not included in this area.

Remaining lots designated for industrial purposes include:

- **Lot C.** Lot C is the group of parcels along Corporate Drive, in the northwest section of the SHIP. Lot C was permitted by Land Use Permit #4C0329-17-EB in 1999. There are 12 undeveloped parcels remaining (consisting of 37 acres in total), which are permitted a certain number of peak hour trips according to the land use permit.
- **30 & 42 Allen Martin Drive.** This lot is located along the west side of Allen Martin Drive south of Corporate Drive. It is permitted to have two 180,000 SF buildings and one 60,000 SF buildings. One 180,000 SF building has already been built but is not yet occupied.
- **Allen Brook Development.** Allen Brook Development owns land designated for industrial uses in various areas east of Allen Martin Drive. The company has 162.76 acres of developable land, including 116 acres not yet designated for a particular use, 27.5 acres designated only for sand extraction, and a temporary no-build easement of 27.5 acres. None of these land uses are currently permitted.
- **Other.** 17 acres off Thompson Drive that are not owned by Allen Brook Development have yet to be developed or permitted.

A map of the SHIP's designated uses, parcel/lot information, and developer information is shown in Figure 25.

FIGURE 25: SHIP BUILDOUT MAP



TRAFFIC VOLUMES ANALYSIS

PERMITTED TRAFFIC VOLUMES

RSG considers permitted traffic to include the remaining allowable trips associated with Lot C and projected trips from the existing but unoccupied building at 30-42 Allen Martin Drive.

Lot C (Corporate Drive)

Approximately half of the parcels in Lot C have been developed since 1999, when the Land Use Permit for Lot C was issued. This is in line with the number of peak hour trips remaining; approximately half of all permitted trips in Lot C have been generated.

Lot C has 184 approved trips remaining in the weekday morning peak hour and 137 approved trips remaining in the weekday evening peak hour. These numbers were found in the July 2015 traffic impact study for Saxon Hill Corporation's proposed warehouse building at 14 Corporate Drive; these numbers include projected trips from 14 Corporate Drive since the warehouse has not yet been constructed.

To determine enter and exit distribution of these trips, ITE Industrial Park Land Use (code 130) was used (Table 4). The trip generation and enter/exit distribution of Lot C is shown in Table 5.

30-42 Allen Martin Drive (Existing, unoccupied building)

According to the 2013 Traffic Impact Assessment for 30-42 Allen Martin Drive, it is expected that the buildings on this Lot will consist of 50% manufacturing use and 50% warehousing use. Trip generation and enter/exit distribution of the existing, unoccupied 180,000 SF building at 30-42 Allen Martin Drive reflect this projection using the ITE Manufacturing Land Use (code 140) and the ITE Warehousing Land Use (code 150) (see Table 4). When occupied full time, this building is expected to generate 93 weekday morning peak hour trips and 95 weekday evening peak hour trips. The trip generation and enter/exit distribution of 30-42 Allen Martin Drive are shown in Table 5.

TABLE 4: ITE LAND USE TRIP GENERATION RATES

	AM			PM		
	Trip Rate	Enter	Exit	Trip Rate	Enter	Exit
ITE: Industrial Park (130)	8.55/acre	83%	17%	8.84/acre	21%	79%
ITE: Warehousing (150)	0.3/1000 SF	79%	21%	0.32/1000 SF	25%	75%

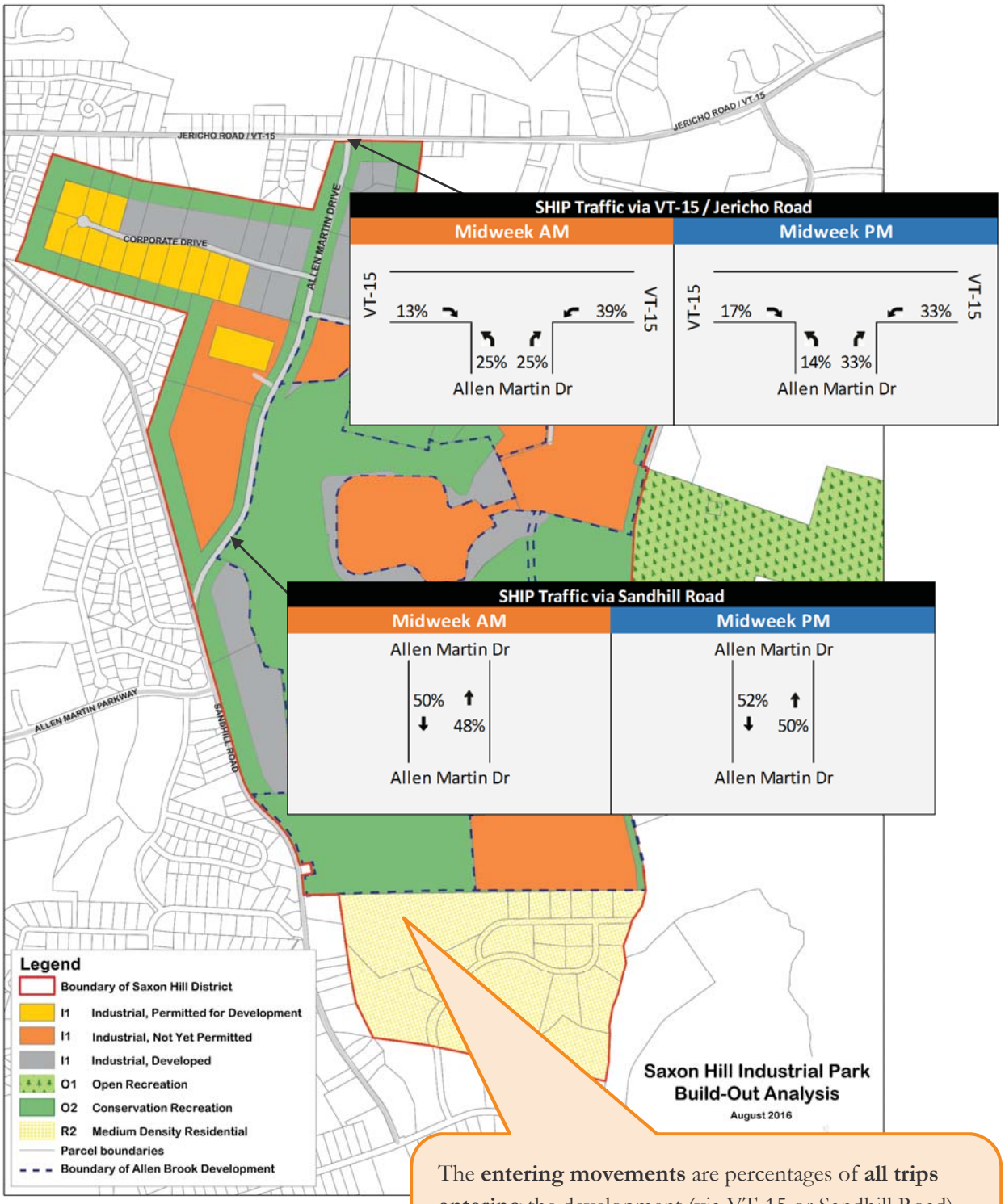
TABLE 5: PERMITTED TRIP GENERATION AND DISTRIBUTION

Permitted Developments	Parcel Information		Trip Generation						
	Total Acreage of Undeveloped Parcels (including residential buffer)	Building Square Footage	Basis of Trip Generation	AM			PM		
				Enter	Exit	*Total*	Enter	Exit	*Total*
Lot C (Corporate Drive)	36.9	N/A	**Trips:** Land Use Permit **Enter/Exit:** ITE: Industrial Park (130) based on acreage	153	31	*184*	29	108	*137*
30-42 Allen Martin Drive existing building	20	180,000	ITE: 50% Manufacturing (140) and 50% Warehousing (150) based on square footage	73	20	*93*	31	64	*95*
TOTAL				**225**	**51**	***277***	**60**	**172**	***232***

Trip Distribution of the SHIP Permitted Trips

The currently permitted trips were distributed proportionally using the same methodology used for the 2012 traffic impact study (TIS) for the Reinhart Food Service warehouse, located on Thompson Drive in the SHIP. The distribution percentage and the study area distribution of the permitted trips is illustrated in Figure 26 and Figure 27, respectively.

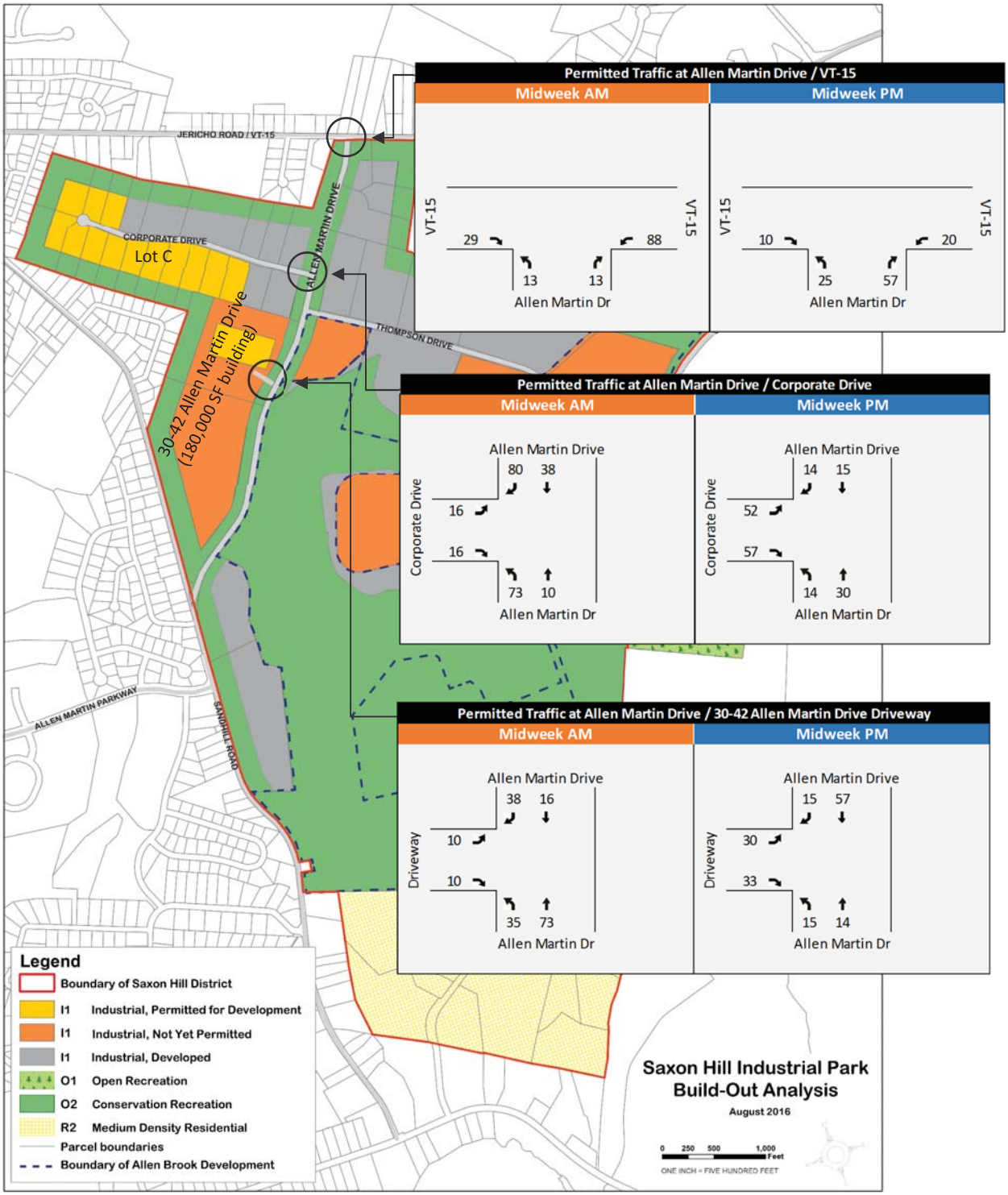
FIGURE 26: TRIP DISTRIBUTION VIA VT-15 AND SANDHILL ROAD (BASED ON REINHART TIS)



The **entering movements** are percentages of **all trips entering** the development (via VT-15 or Sandhill Road).

The **exiting movements** are percentages of **all trips exiting** the development (via VT-15 or Sandhill Road).

FIGURE 27: PERMITTED TRIP GENERATION AND DISTRIBUTION, 2016



FUTURE YEAR VOLUMES

RSG projected traffic volumes to 2036 - 20 years from now - when the SHIP will likely be fully developed. In addition to the permitted trips (Lot C and the building currently at 30-42 Allen Martin Drive), RSG considered the following remaining parcels as projected future trip generators:

- **30-42 Allen Martin Drive:** Future second 180,000 SF building and future 60,000 SF building
- **Allen Brook Development:** 143.5 developable acres, including 116 non-designated acres and 27.5 acres designated for sand extraction. The proposed temporary no-build area of 27.5 acres was not included; it will not be developed until after the sand extraction area has been reclaimed as forest land.
- **Thompson Drive:** 17 developable acres

Projected trips for each of these is shown in Table 6. Because future building square footage of most of these properties is unknown, acreage was used as a variable with the ITE land use Industrial Park (130) to determine trip generation (see Table 4 for the ITE rates). The zoning regulations of the Town of Essex limit development on designated industrial properties in the RPD-I district to 60% of a property; thus, trips are based on 60% of the total available acreage of a property. The residential buffer is included in the remaining non-developable area of each property.

TABLE 6: PROJECTED TRIP GENERATION AND DISTRIBUTION

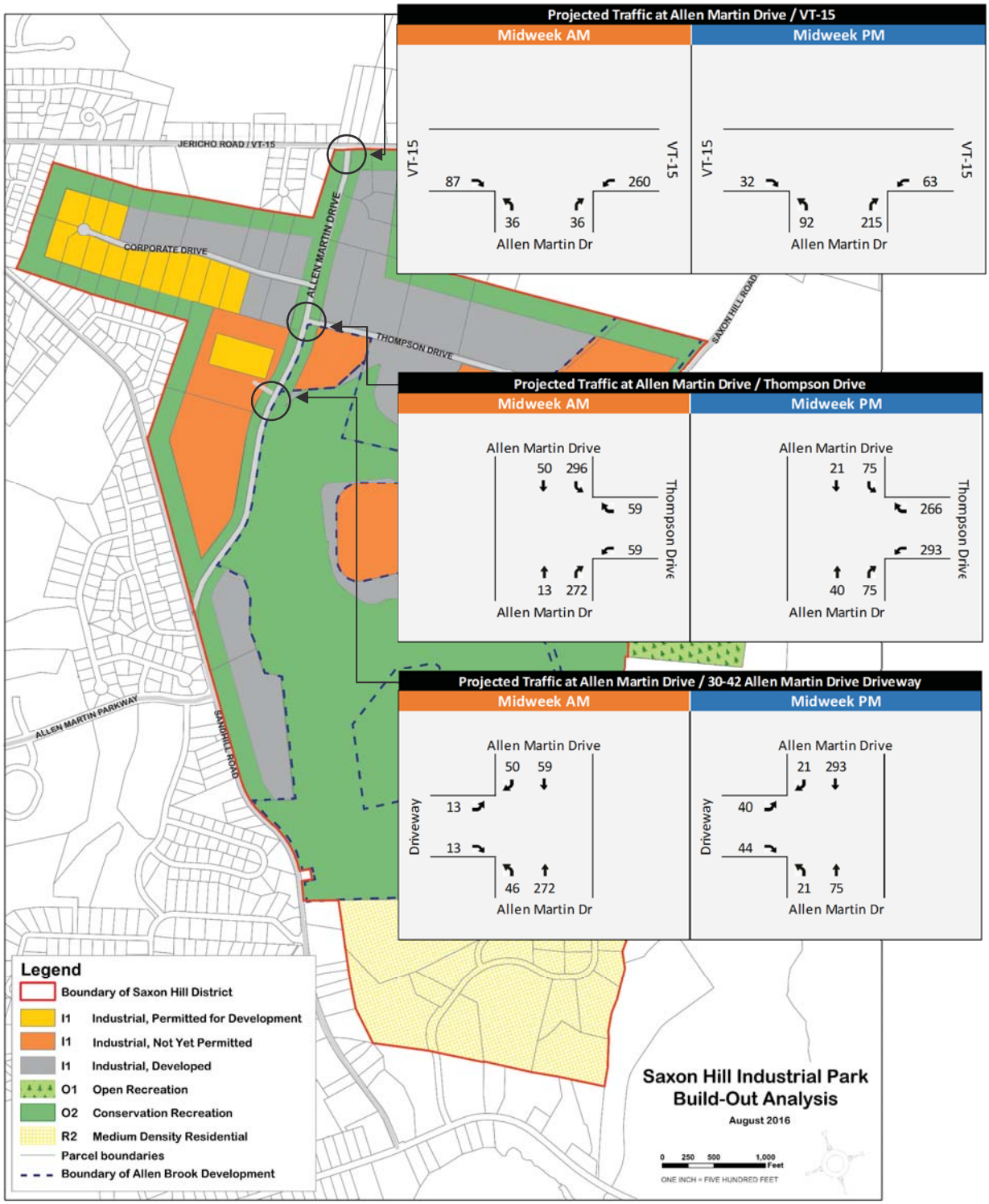
Potential Developments	Parcel Information			Trip Generation						
	Total Acreage of Undeveloped Parcels (including residential buffer)	60% of Developable Acreage (residential buffer included in remaining 40%)	Building Square Footage	Basis of Trip Generation	AM			PM		
					Enter	Exit	*Total*	Enter	Exit	*Total*
30-42 Allen Martin Drive remaining space	33	20	240,000	ITE: 50% Manufacturing (140) and 50% Warehousing (150) based on square footage	97	27	*124*	41	85	*126*
Allen Brook Development (not including sand extraction area)	116	70	N/A	ITE: Industrial Park (130) based on acreage	494	101	*595*	129	486	*615*
Allen Brook Development - Sand Extraction	28	17	N/A	Traffic Impact Study (2016, via Act 250 permit application)	1	1	*2*	1	1	*2*
Remaining Thompson Drive space	17	10	N/A	ITE: Industrial Park (130) based on acreage	73	15	*88*	19	72	*91*
TOTAL					**668**	**149**	***816***	**195**	**647**	***842***

Potential Trips at VT-15 and Allen Martin Drive Intersection

To determine the number of generated trips associated with the full build-out that pass through the intersection of VT-15 and Allen Martin Drive, as well as the approach and exit directions of those trips, RSG used the same methodology used for permitted trips; projected turning movements from the Reinhart TIS were used to split the trips proportionally (see Figure 26).

A map of the study area showing all potential (not including permitted) trips and their enter and exit distributions is shown in Figure 28.

FIGURE 28: PROJECTED TRIP GENERATION FROM NOT YET PERMITTED LAND USES WITHIN THE SHIP



SUMMARY OF VT ROUTE 15 / ALLEN MARTIN DRIVE TRAFFIC VOLUMES

FIGURE 29: 2016 EXISTING TRAFFIC VOLUMES (NO BUILD)

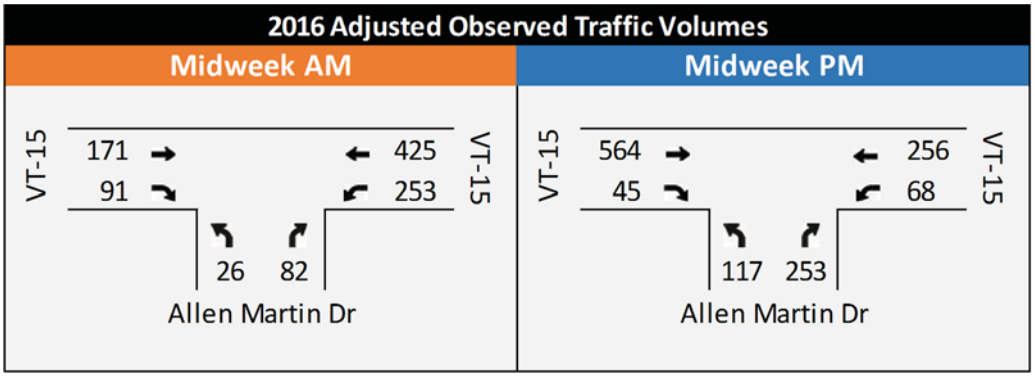
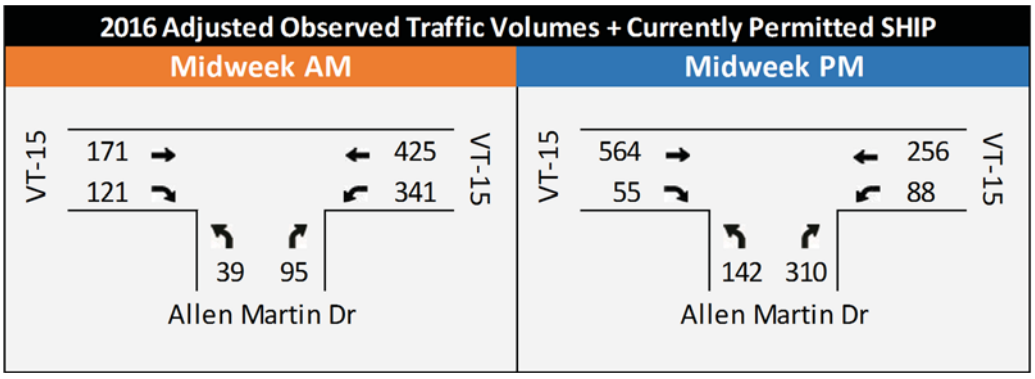


FIGURE 30: 2016 PERMITTED TRAFFIC VOLUMES (BUILD)



Projecting to 2036, RSG applied a growth factor of 0.5% per year, for a total growth factor of +10.5%, to the adjusted observed traffic volumes. Figure 31 and Figure 32 show the Permitted and Projected volumes of the VT-15 and Allen Martin Drive intersection in 2036 with this growth factor applied to the adjusted observed volumes.

FIGURE 31: 2036 PERMITTED TRAFFIC VOLUMES (NO BUILD)

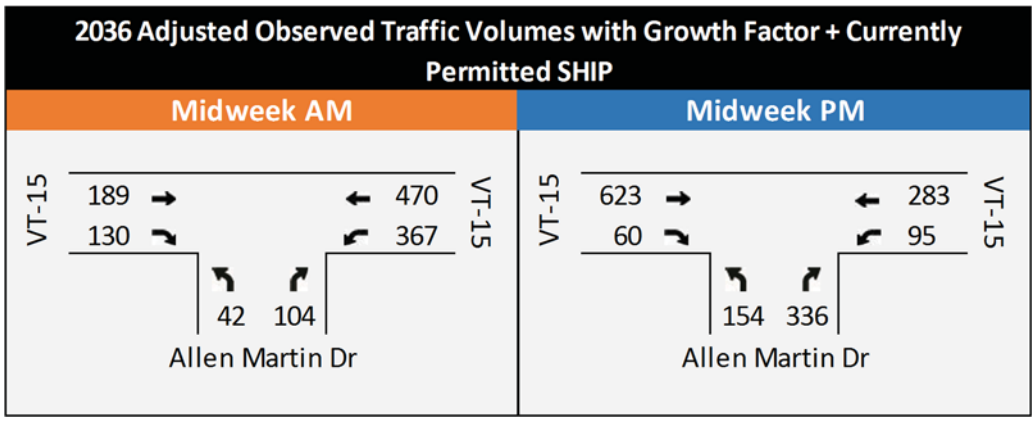
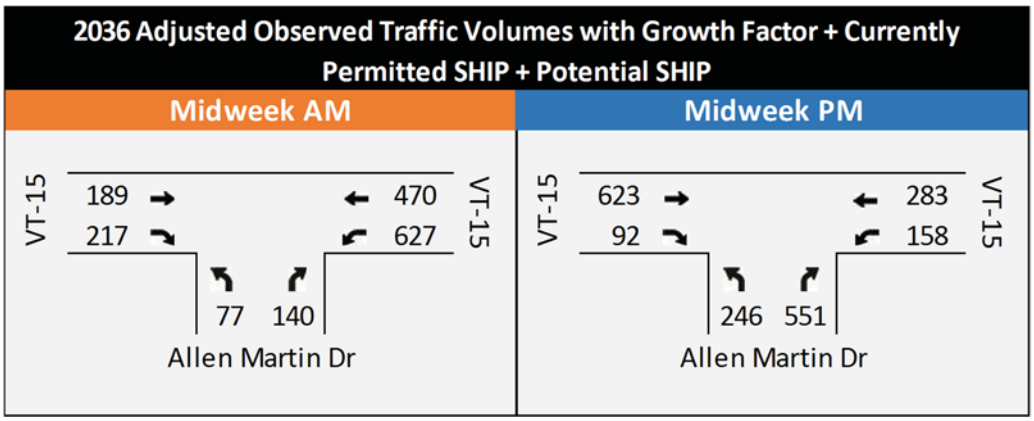


FIGURE 32: 2036 PROJECTED TRAFFIC VOLUMES (BUILD)



LEVEL-OF-SERVICE ANALYSIS

LEVEL-OF-SERVICE DEFINITION

Level-of-service (LOS) is a qualitative measure describing the operating conditions as perceived by motorists driving in a traffic stream. LOS is calculated using the procedures outlined in the 2000 and 2010 Highway Capacity Manuals.[2] In addition to traffic volumes, key inputs include the number of lanes at each intersection, traffic control type (signalized or unsignalized), and the traffic signal timing plans.

The 2010 Highway Capacity Manual defines six qualitative grades to describe the level of service at an intersection. Level-of-Service is based on the average control delay per vehicle.

[2] The HCM 2010 does not provide methodologies for calculating intersection delays at certain intersection types including signalized intersections with exclusive pedestrian phases and signalized intersections with non NEMA-standard phasing. Because of these limitations, HCM 2000 methodologies are employed where necessary.

Table 7 shows the various LOS grades and descriptions for signalized and unsignalized intersections.

TABLE 7: LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED AND UNSIGNALIZED INTERSECTIONS

LOS	CHARACTERISTICS	UNSIGNALIZED AVERAGE DELAY (SEC)	SIGNALIZED AVERAGE DELAY (SEC)
A	Little or no delay	≤ 10.0	≤ 10.0
B	Short delays	10.1-15.0	10.1-20.0
C	Average delays	15.1-25.0	20.1-35.0
D	Long delays	25.1-35.0	35.1-55.0
E	Very long delays	35.1-50.0	55.1-80.0
F	Extreme delays	> 50.0	> 80.0

The delay thresholds for LOS at signalized and unsignalized intersections differ because of the driver's expectations of the operating efficiency for the respective traffic control conditions. According to HCM procedures, an overall LOS cannot be calculated for two-way stop-controlled intersections because not all movements experience delay. In signalized and all-way stop-controlled intersections, all movements experience delay and an overall LOS can be calculated.

The VTrans policy on level of service for **Signalized and All-Way Stop Intersections** is:

- Overall LOS C should be maintained for state-maintained highways and other streets accessing the state's facilities
- Reduced LOS may be acceptable on a case-by-case basis when considering, at minimum, current and future traffic volumes, delays, volume to capacity ratios, crash rates, and negative impacts as a result of improvement necessary to achieve LOS C.

The VTrans policy on level of service for **Two-Way and One-Way Stop Intersections** is:

- LOS D should be maintained for side roads with volumes exceeding 100 vehicles/hour for a single lane approach (150 vehicles/hour for a two-lane approach) at two-way stop-controlled intersections. No LOS criteria are in effect for volumes less than these.

LEVEL-OF-SERVICE RESULTS

The Highway Capacity Manual congestion reports within Synchro (version 9), a traffic analysis software package from Trafficware that is routinely relied upon by transportation engineering professionals, were used to assess traffic congestion at the study intersection with the existing volumes and intersection geometry. Table 8 and Table 9 present the LOS results during the weekday AM and PM peak hours, respectively.

TABLE 8: AM PEAK HOUR TRAFFIC ANALYSIS RESULTS

Movement	2016 Existing (No Build)			2016 Permitted (Build)			2036 Permitted (No Build)			2036 Projected (Build)		
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c
NB Left	D	28	0.14	E	47	0.32	F	66	0.42	F	>100	2.66
NB Right	A	10	0.09	A	10	0.11	A	10	0.12	B	10	0.17
WB Left	A	8	0.18	A	8	0.24	A	9	0.27	A	10	0.45

TABLE 9: PM PEAK HOUR TRAFFIC ANALYSIS RESULTS

Movement	2016 Existing (No Build)			2016 Permitted (Build)			2036 Permitted (No Build)			2036 Projected (Build)		
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c
NB Left	D	29	0.44	E	38	0.58	F	58	0.73	F	>100	1.53
NB Right	C	18	0.48	C	21	0.59	D	27	0.69	F	>100	1.12
WB Left	A	9	0.07	A	9	0.09	A	9	0.10	A	10	0.16

Detailed Synchro LOS worksheets are available in Appendix A.

Discussion

Existing Conditions: A-D. All turning movements in both the AM and PM peak hours currently meet the VTrans acceptable minimum LOS of D for minor leg stop-controlled intersections.

Northbound Left Movements: D, E, and F. For AM and PM peak hours in the 2016 Permitted scenarios, northbound left turns do not meet the VTrans acceptable minimum LOS of D. This is primarily due to the lack of sufficient gaps in through traffic on VT-15, and also partially due to westbound left turns onto Allen Martin Drive. In the 2036 Permitted scenario, the northbound left turn movement worsens to an F in both AM and PM peak hours due to the increase in through traffic due to 20-year growth. In the 2036 Projected scenario, the northbound left turn movement is an F with delay and v/c numbers well over the minimum necessary to be rated as an F.

Northbound Right Movements: A - F. In the AM peak hour for all scenarios, northbound right turns experience negligible delays as most through traffic heads west (not conflicting with northbound right turns). In the PM peak hour, when most through traffic heads east and when there are significantly more northbound right movements than in the AM peak hour as vehicles exit the SHIP, LOS's range from C to F. Vehicles taking this right turn do not need to cross traffic and experience delay that comes from that, but they must wait behind northbound vehicles waiting to turn left. A greater delay for northbound left turns results in a greater delay for northbound right turns. In the 2016 and 2036 Permitted scenarios, the northbound right movement meets the VTrans minimum LOS of D. This movement worsens to a failing F in the 2036 Projected scenario.

Westbound Left Movements: A. In all scenarios, for both the AM and PM peak hours, westbound left turns experience negligible delays despite crossing eastbound through traffic.

QUEUING ANALYSIS

In addition to the congestion analysis, estimated average maximum queues were evaluated using SimTraffic. Five one-hour-long simulations were averaged together to estimate queue lengths,[3] shown in Table 10.

TABLE 10: AVERAGE MAXIMUM QUEUE LENGTHS (IN FEET)

	AM Peak Hour				PM Peak Hour			
	2016		2036		2016		2036	
Approach	Existing (No Build)	Permitted (Build)	Permitted (No Build)	Projected (Build)	Existing (No Build)	Permitted (Build)	Permitted (No Build)	Projected (Build)
EB	1	3	3	12	0	0	0	1
WB	53	79	92	421	22	27	50	76
NB	13	15	18	467	41	71	174	776

Detailed SimTraffic queuing worksheets are available in Appendix B.

Discussion

2016 Existing and Permitted queue lengths are generally acceptable; the highest estimated queue length is of approximately 80 feet in the AM Permitted westbound approach. Westbound queues are likely most often a result of westbound through vehicles being blocked from continuing past the intersection due to one westbound left-turning vehicle waiting for a sufficient gap in eastbound traffic to turn onto Allen Martin Drive.

Queue lengths in the westbound and northbound approaches are expected to experience minimal increases due to growth in through traffic between the 2016 and 2036 Permitted scenarios. The northbound PM approach is one exception; its queues are expected to increase from 71 feet to 174 feet between these two scenarios.

Queue lengths in the westbound and northbound approaches are expected to significantly increase due to the buildout of the SHIP. The northbound approach will experience a greater increase compared to the westbound approach in both the AM and PM peak hours between the 2036 Permitted and Projected scenarios - from 18 feet to 467 feet in the AM peak and from 174 feet to 776 feet in the PM peak. The westbound approach will experience a much greater increase in queue length in the AM peak hour than the PM peak hour - from 92 feet to 421 feet in the AM peak and from 50 feet to 76 feet in the PM peak. This is due to a much greater number of vehicles due to the SHIP buildout approaching from the west in the morning than in the afternoon.

[3] Five one-hour-long simulations were averaged together to estimate queue lengths. As each run is different, a difference of less than 50 feet should not be seen as significant.

TURN LANE WARRANT ANALYSIS

In assessing the SHIP access via VT-15, a turn lane warrant analysis was conducted for westbound left turns and eastbound right turns onto Allen Martin Drive from VT-15. Dedicated turn lanes have the safety and capacity benefits of removing turning traffic from the through volume traffic stream but also promote higher vehicle speeds and require increased pavement widths.

WESTBOUND LEFT TURN LANE

Using Harmelink's methodology for unsignalized intersections, it was found that volume warrants necessary for construction of a dedicated westbound left-turn lane **are met** during the weekday AM and PM peak hours at this site, based on existing traffic conditions and roadway characteristics (40 mph posted speed limit). This method is shown graphically in Figure 33, with supporting numbers in Table 11.

FIGURE 33: WESTBOUND LEFT TURN LANE HARMELINK WARRANT FOR 2016 EXISTING CONDITIONS

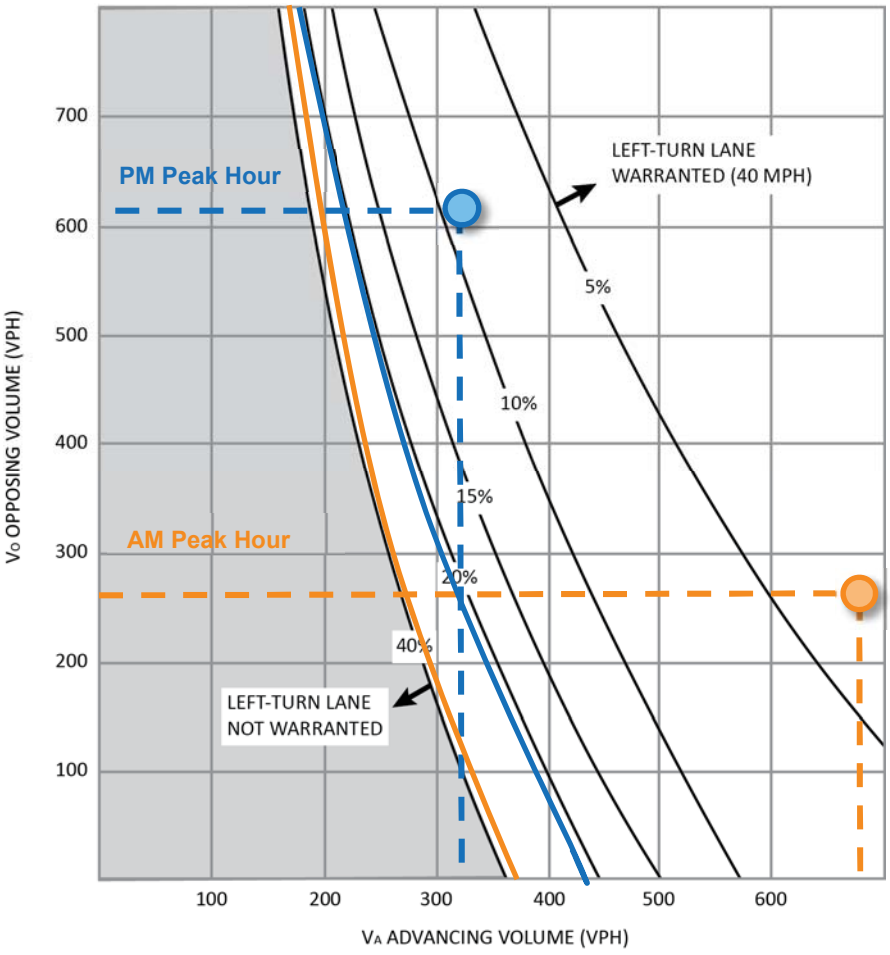


TABLE 11: WESTBOUND LEFT TURN LANE HARMELINK WARRANT FOR 2016 EXISTING CONDITIONS

	AM Peak Hour	PM Peak Hour
Advancing (WB) Volume (V_A)	678	324
Opposing (EB) Volume (V_O)	263	609
% Left Turns	37%	21%
Warranted?	Yes	Yes

Because a westbound left turn lane is warranted at the study intersection for existing observed traffic conditions, a left turn lane will continue to be warranted, and by greater amounts, as the SHIP continues to be developed.

EASTBOUND RIGHT TURN LANE

A warrant analysis was conducted for the existing eastbound right turn lane from VT-15 onto Allen Martin Drive using the VTrans Right Turn Auxiliary Lanes Traffic Volume Warrants. According to this methodology, an eastbound right turn lane is **not warranted** under the existing traffic conditions in AM or PM peak hours (see Figure 34). **An eastbound right turn lane is only warranted at the study intersection for 2036 Projected volumes in the PM peak hour** (see Table 12).

FIGURE 34: EASTBOUND RIGHT TURN LANE VTRANS WARRANT FOR 2016 EXISTING CONDITIONS

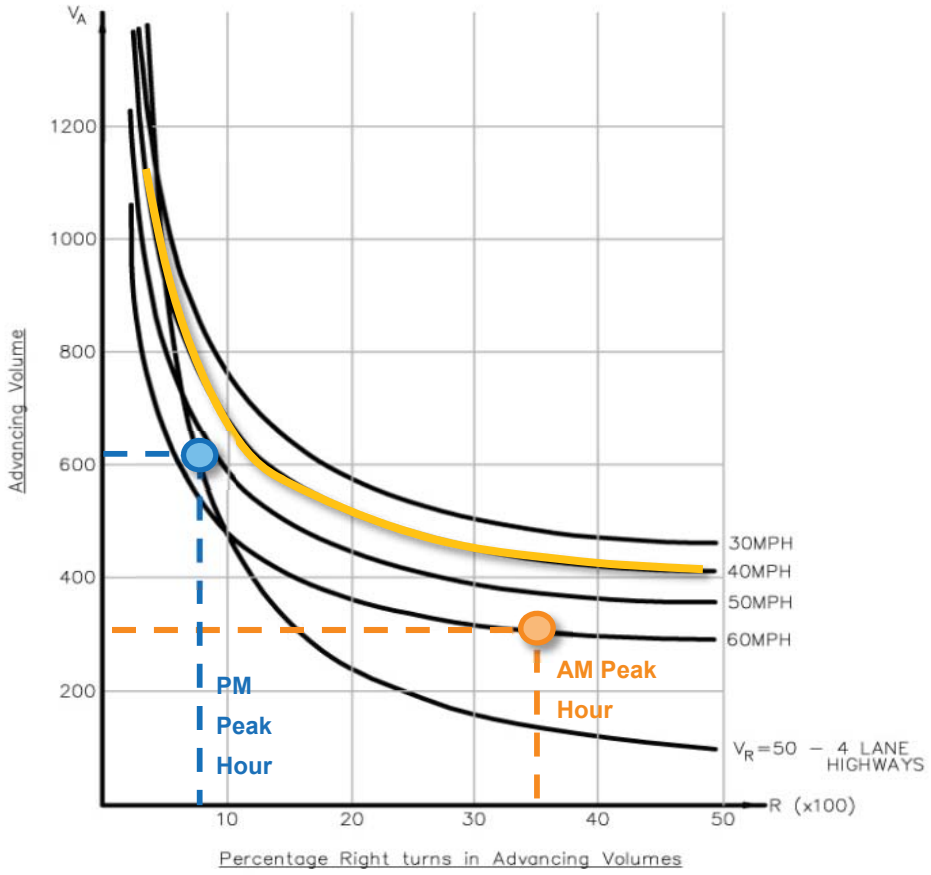


TABLE 12: EASTBOUND RIGHT TURN LANE VTRANS WARRANT FOR ALL SCENARIOS

AM Peak Hour	2016 Existing	2016 Permitted	2036 Permitted	2036 Projected
Advancing (EB) Volume	263	292	320	406
% Right Turns	35%	41%	41%	53%
Warranted?	No	No	No	No
PM Peak Hour	2016 Existing	2016 Permitted	2036 Permitted	2036 Projected
Advancing (EB) Volume	609	619	683	714
% Right Turns	7%	9%	9%	13%
Warranted?	No	No	No	Yes

Although an eastbound right turn lane is not currently warranted according to existing traffic volumes, the turn lane serves the operational characteristics of large vehicles traveling through the intersection accessing the industrial park. Large vehicles account for approximately 7% of the vehicle volume in the AM Peak Hour. Eastbound trucks turning right onto Allen Martin Drive may first decelerate in the turn lane. To accomplish the turning maneuver, trucks may be required to overturn, or encroach on either the eastbound

through or northbound left turn lane to avoid off-tracking of the trailer outside the pavement (Figure 35).

FIGURE 35: TRUCK TURNING RADIUS (WB-67)

SIGNAL WARRANT ANALYSES

RSG conducted signal warrant analyses for the existing conditions and for the future (2036) conditions with permitted volumes using PC Warrants, a software from Ridge Engineering, which performs signal warrants according to the MUTCD. The existing conditions analysis of the study intersection is based on observed data from RSG's 12-hour turning movement count on April 14, 2016[4]. The future conditions analysis includes permitted volumes and a growth factor of 0.5% per year applied to the observed volumes.

A signal warrant analysis is a set of tests that are run to determine whether a traffic signal would significantly improve operations, mobility, and safety at an intersection. There is a total of 8 warrants. The warrants are described below, and with each one is a discussion of how the study intersection does or does not meet the warrant. The PC Warrants signal warrant analysis report is in Appendix C. Calculations used to determine the increase in developed acres required to meet the warrant are in Appendix D.

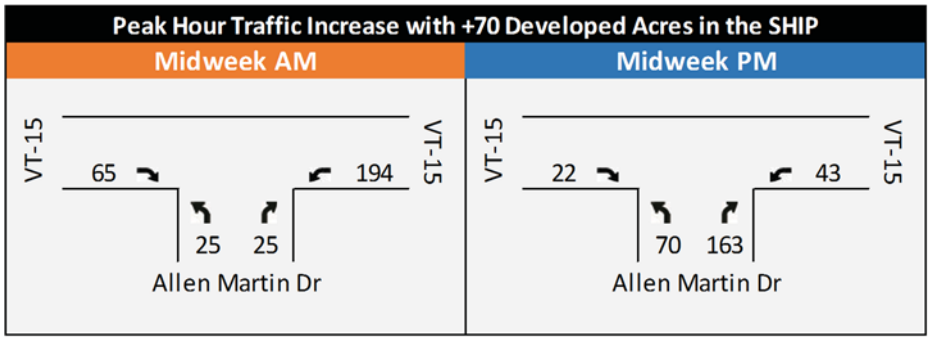
[4] Raw counts were multiplied by a daily adjustment factor of 0.92 to adjust the data to an average day, as recommended by the MUTCD for signal warrants. The adjustment factor was found in the 2014 VTrans Red Book using continuous traffic counter P6D531 on the second Thursday in April 2014 - April 10 - to match RSG's data collected on the second Thursday in 2016.

EXISTING CONDITIONS SIGNAL WARRANT ANALYSIS

1) ***Eight-Hour Vehicular Traffic Warrant:*** **when a large amount of intersecting traffic occurring over an 8-hour period is the principal reason for installing a traffic signal, or where excessive delays occur on minor approaches to an intersection.**

   - There are three conditions that can be applied to meet this warrant, only one of which must be satisfied to meet the warrant. Each of the three conditions require a minimum volume on the major street and a minimum volume on the minor street for any 8 hours of an average day. Because the study intersection meets these volume requirements for only 3 hours of the day, **this warrant is not met.**
   - Allen Martin Drive's total enter and exit volumes would need to increase by approximately **40%** between 6AM and 6PM to meet this warrant. This is equivalent to an increase of approximately 1170 trips across 12 hours, or **70 developed acres.** The effect this growth would have on the peak hour volumes is shown in Figure 36.

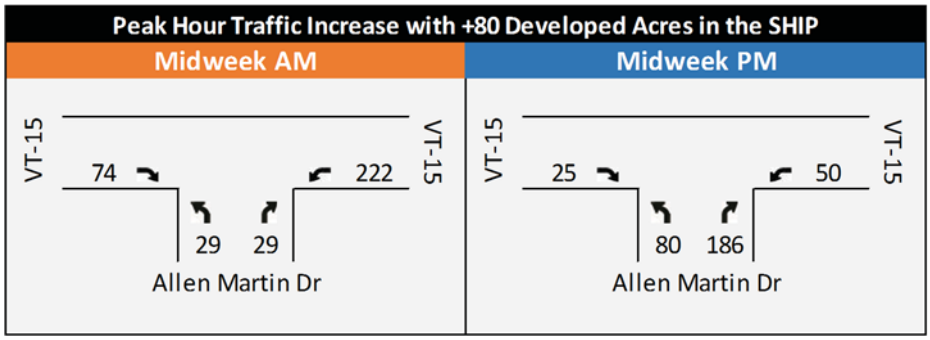
FIGURE 36: PEAK HOUR TRAFFIC INCREASE FOR 8-HOUR WARRANT



2) ***Four-Hour Vehicular Traffic Warrant:*** **when a large amount of intersecting traffic occurring over a 4-hour period is the principal reason for installing a traffic signal.**

   - To meet this warrant, an intersection must have a minimum volume on the major street and a minimum volume on the minor street for any 4 hours of an average day. Because the study intersection meets the requirements for only 2 hours of the day, **this warrant is not met.**
   - Allen Martin Drive's approach volumes would need to increase by approximately **45%** between 6AM and 6PM to meet this warrant. This is equivalent to an increase of approximately 1,320 trips across 12 hours, or **80 developed acres**. The effect this growth would have on the peak hour volumes is shown in Figure 37.

FIGURE 37: PEAK HOUR TRAFFIC INCREASE FOR 4-HOUR WARRANT



3) ***Peak Hour Warrant:*** **when the minor-street traffic suffers unduly delay when entering or crossing the major-street during the average peak hour is the principal reason for installing a traffic signal.**

- There are two conditions that can be applied to meet this warrant, only one of which must be satisfied to meet the warrant. Both conditions require a minimum volume on the major street and a minimum volume on the minor street for 1 hour (any four consecutive 15-minute periods) of an average day. Because the study intersection meets the required volumes for 1 hour, **this warrant is met.**

4) ***Pedestrian Volume Warrant:*** **when the traffic volumes on a major street are so heavy that pedestrians experience excessive delays.**

- Because the number of pedestrians crossing the study intersection is an order of magnitude beneath the necessary threshold to meet this warrant, **this warrant is not applicable.**

5) ***School Crossing Warrant:*** **when school children crossing a major street are the principal reason for installing a traffic signal.**

- Because there is no school in the vicinity of the study intersection, **this warrant is not applicable.**

6) ***Coordinated Signal System Warrant:*** **when maintaining proper platooning of vehicles is the principal reason for installing a traffic signal.**

- Because the study intersection is not along a road with frequent traffic signals, **this warrant is not applicable.**

7) ***Crash Experience Warrant:*** **when the severity and frequency of accidents is the principal reason for installing a traffic signal.**

- Because the study intersection experienced less than five crashes in the past 12 months, and the type of crashes experienced at the intersection would not expected to be reduced by a signal, **this warrant is not met.**

8) ***Roadway Network Warrant:*** **when the concentration and organization of traffic flow at the intersection of two or more major routes is the principal reason for installing a traffic signal.**

- Because the SHIP buildout will not make Allen Martin Drive a "major route", **this warrant is not applicable.**

9) ***Intersection Near a Grade Crossing:*** **when the proximity to a railroad crossing is the principal reason for installing a traffic signal.**

- Because there is no proximate railroad crossing, **this warrant is not applicable.**

A signal warrant analysis is considered advisory only. This means that simply meeting any warrant may not be sufficient cause for installing a traffic signal. For example, meeting the peak hour warrant is usually not sufficient in and of itself to warrant installing a traffic signal. The rationale for this is that one hour (or less) of congestion in a day is probably not severe enough to justify the investment in the traffic signal controller and related equipment and software. Experience in Vermont suggests that meeting at least two other warrants is needed to justify investment in a traffic signal. **RSG found only one of the eight signal warrants were met; thus, a traffic signal is <u>not</u> currently warranted at the VT-15 / Allen Martin Drive intersection.**

2036 PERMITTED VOLUMES (NO BUILD)

1) ***Eight-Hour Vehicular Traffic Warrant***

- Because the study intersection meets the volume requirements for 8 hours of the day, **this warrant is met.**

2) ***Four-Hour Vehicular Traffic Warrant***

- Because the study intersection meets the volume requirements for 5 hours of the day, **this warrant is met.**

3) ***Peak Hour Warrant***

- Because the study intersection meets the required volumes for 8 hours, **this warrant is met.**

W*arrants 4-9:* The applicability of the remaining warrants is the same for 2036 permitted volumes as it is for existing volumes. Warrant 7 (Crash Experience) is not met, and the rest are not applicable.

SUMMARY OF KEY TRAFFIC FINDINGS

- All movements at the study intersection currently meet the minimum required level-of-service (LOS) D by the Vermont Agency of Transportation (VTrans) in the AM and PM peak hours.

- Northbound right and left turns from Allen Martin Drive onto VT Route 15 currently experience acceptable delay, but the proposed buildout of the Saxon Hill Industrial Park (SHIP) will bring these movements below the VTrans minimum required LOS of D.
- The northbound and westbound approaches to the study intersection currently experience queueing of no more than approximately 60 feet, but with the buildout of the SHIP, queues will significantly increase.
- A westbound left turn lane on VT-15 at the approach to Allen Martin Drive is currently warranted.
- A signal or roundabout is not currently warranted at the study intersection, but will be as development within the SHIP continues.

5.0 ALTERNATIVES DEVELOPMENT AND ANALYSIS

The existing conditions analysis, traffic analysis, and feedback from the Local Concerns Meeting highlighted a number of concerns and issues at the VT-15 and Allen Martin Drive intersections. These include:

- Rear-end crashes on VT-15
- Congestion on Allen Martin Drive
- Congestion on VT-15
- Speeding vehicles along VT-15
- Engine braking noise from vehicles slowing on the approach to the Essex Center 35 mph speed zone near Allen Martin Drive
- Uncomfortable environment for pedestrians

These issues were the basis of the initial alternatives development; every issue may be partially addressed with at least one of the proposed alternatives. Figure 38 lists each alternative and the issues that it may help alleviate, and the following pages provide details of each alternative.

FIGURE 38: ALTERNATIVES AND ISSUES ADDRESSED

		Rear-end crashes on VT-15	Congestion on Allen Martin Drive	Congestion on VT Route 15	Speeding vehicles along VT-15	Engine braking noise from vehicles entering speed zone	Uncomfortable environment for pedestrians
Short Term							
S1	Restrict Engine Braking					X	X
S2	Extend 35 mph speed zone				X		X
S3	Striped shoulder on VT-15 adjacent to turn lane island		X				
S4	Intersection warning sign on approach to Allen Martin Drive on VT-15	X					
Medium Term							
M1	Extend green space into VT-15 near turn lane island (permanent S3)		X				
M2	Add a WB left turn lane	X		X			
M3	Extend sidewalk along VT-15 from Sandhill Rd				X		X
M4	Add / extend separate NB right- and left-turn lanes		X				
M5	Widen eastbound right turn curve radius			X			
M6	Flashing intersection beacon	X					
Long Term							
L1	Construct Allen Martin Parkway exit from VT-289		X				
L2	Construct Thompson Drive extension to VT-117		X				
L3	Intersection Control Modification: Signal		X				X
L4	Intersection Control Modification: Roundabout	X	X		X		X
L5	Construct connection to Saxon Hill Road		X				

A number of alternatives were determined to be infeasible as documented in the Alternatives Analysis Technical Memorandum #3, included as Appendix H. These alternatives are listed in Figure 38 as red text, and are not discussed further in this document.

SHORT TERM ALTERNATIVES

In the short term, it is recommended that the hatched shoulder is repainted (Alternative S3). In addition, a speed study (S2) is recommended to document the appropriate speed for the roadway. The enhanced intersection warning sign is not recommended if the medium- or long-term alternatives are pursued.

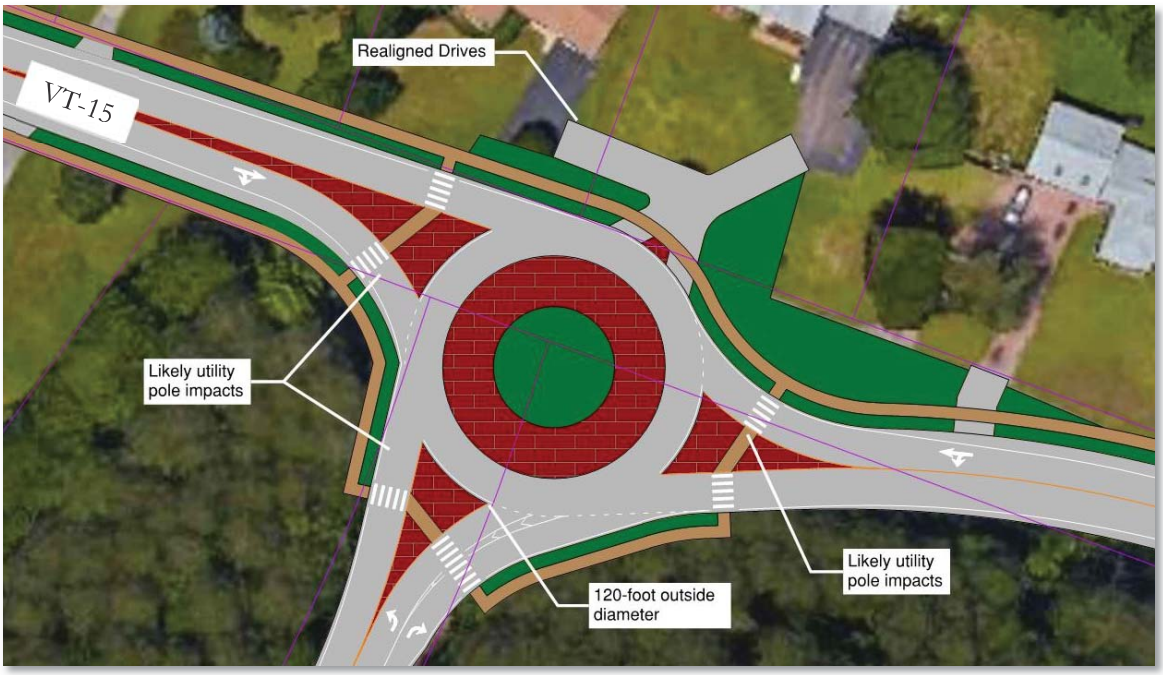
PREVIOUSLY EXISTING SHOULDER HATCHED STRIPING (ALTERNATIVE S3) FROM 2011 (GOOGLE STREET VIEW)

MEDIUM- AND LONG- TERM ALTERNATIVES

Medium- and long-term recommendations are dependent on the preferred intersection control mechanism (traffic signal or roundabout) and implementation timeline. Both intersection control mechanisms operate acceptably under future 2036 SHIP build-out traffic scenarios.

The roundabout (L4) is generally considered safer, with reduced severity of crashes, a traffic calming effect, two stage pedestrian crossing, and overall reduced emissions and delay. A roundabout has fewer interim steps and would result in a greater initial investment to construct the ultimate intersection, although additional funding sources may be available to construct the safer intersection.

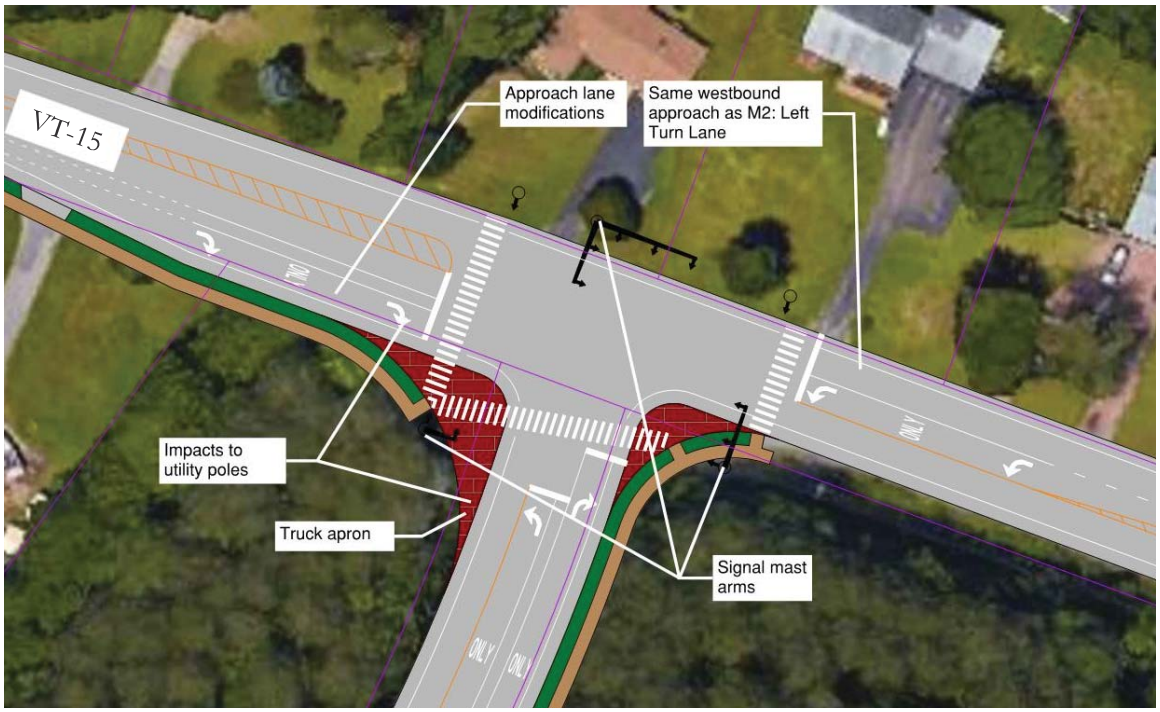
FIGURE 39: ULTIMATE ROUNDABOUT ALTERNATIVE: 120-FOOT INSCRIBED DIAMETER



The construction of a roundabout would not benefit from any of the medium term alternatives except for the extension of the northbound approach lanes. In the medium term, the Allen Martin Drive northbound left- and right-turn lanes could be extended to allow right turning vehicles to bypass the left turning queue in the existing, stop controlled configuration; this extended turn lane could be incorporated into the ultimate roundabout design. All other medium term recommendations would be removed for the construction of the roundabout.

The traffic signal (L3), estimated at a lower overall cost, could be implemented in stages: first, with the construction of the medium term improvements, such as widening the road for the left turn lane and installing the flashing intersection warning beacon, and finally installing the ultimate signal. However, the signal does not provide any traffic calming, has significantly longer pedestrian crossing lengths, and exposes more conflicting traffic movements resulting in a greater likelihood of the more severe head-on and side collision crash types.

FIGURE 40: ULTIMATE SIGNALIZED ALTERNATIVE



OPERATIONAL ANALYSIS

The intersection of Allen Martin Drive and VT-15 was modeled in Synchro with a signal (Alternative L3) and a roundabout (Alternative L4). These intersection types were applied only to 2036 scenarios (Permitted and Projected), as they are long-term alternatives that are not currently warranted. The VTrans minimum required LOS for these types of intersections is a C. LOS Worksheets for these alternatives are presented in Appendix E.

Signal (Alternative L3)

A signal was modeled with a westbound left turn lane and extended northbound left and right turn lanes. Traffic conditions in all scenarios meet the VTrans minimum required LOS of C, as shown in Table 13.

TABLE 13: LOS FOR SIGNALIZED INTERSECTION, 2036

Movement	AM Peak Hour				PM Peak Hour			
	Permitted (No Build)		Projected (Build)		Permitted (No Build)		Projected (Build)	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
NB Left	A	9.5	B	10.9	A	9.4	A	8.9
NB Right	B	10.8	B	12.7	B	12.8	C	24.5
WB Left	A	5.9	B	18.0	B	12.0	C	21.3
WB Thru	A	4.2	A	4.1	A	5.6	A	8.3
EB Thru	A	3.3	A	3.3	A	9.1	B	16.5
EB Right	A	3.2	A	3.5	A	4.8	A	7.3
Overall	**A**	**5.1**	**B**	**10.0**	**A**	**9.3**	**B**	**16.6**

Roundabout (Alternative L4)

A roundabout was modeled in Sidra Software and using the HCM 6th edition roundabout analysis methodology. The 120-foot inscribed diameter roundabout included two northbound entrance lanes (one to turn left and one as a slip lane right turn); all roundabout exits were one lane. Overall intersection operations in all scenarios meet the VTrans minimum required LOS of C, as shown in Table 14. The westbound approach neared capacity in the AM Build conditions. While acceptable, a two lane entrance at this location (one left turn lane and one through lane) would improve the operation to LOS B for the approach, and LOS A overall.

TABLE 14: LOS FOR ROUNDABOUT INTERSECTION, 2036

Movement	AM Peak Hour				PM Peak Hour			
	Permitted (No Build)		Projected (Build)		Permitted (No Build)		Projected (Build)	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
EB	A	8	B	15	A	9	B	11
WB	B	11	D	26	A	6	A	8
NB	A	4	A	4	A	9	C	16
Overall	**A**	**9**	**C**	**21**	**A**	**9**	**B**	**12**

EVALUATION MATRIX

An evaluation matrix has been prepared for each alternative and is presented in Technical Memorandum #3: Alternatives Analysis as Appendix H.

ALTERNATIVE IMPLEMENTATION DISCUSSION

In the short term, the hatched shoulder may be repainted (Alternative S3) to better define the road space. In addition, a speed study (S2) is recommended to document the appropriate speed for the roadway.

Medium- and long-term alternative implementation is dependent on the preferred intersection control mechanism: traffic signal or roundabout. The roundabout (L4) is generally considered safer, with reduced severity of crashes, a traffic calming effect, two stage pedestrian crossing, and overall reduced emissions and delay. A roundabout has fewer interim steps and would result in a greater initial investment to construct the ultimate intersection, although additional funding sources may be available to construct the safer intersection. The traffic signal (L3), estimated at a lower overall cost, could be implemented in stages: first widening the road, installing the flashing intersection warning beacon, and finally installing the ultimate signal. However, the signal does not provide any traffic calming, has significantly longer pedestrian crossing lengths, and exposes more conflicting traffic movements resulting in a greater likelihood of the more severe head-on and side collision crash types.

Short Term (Now)

Total Short Term	$3,500
Stripe hatched shoulder (S3)	$1,500
Conduct speed study (S2)	$2,000

Medium Term (5 years)

Total Medium Term	$165,000
Extend northbound turn lanes (M4)	$165,000

Total Medium Term	$640,000
Extend splitter island	$17,500
Westbound left turn lane (M2)	$390,000
Extend northbound turn lanes (M4)	$165,000
Widen southwest corner radius (M5)	$17,350
Span wire (M6)	$50,000

Long Term (10-15 years)

Total Long Term	
Ultimate roundabout (L4)	$1.3 - $2.3 million

Total Long Term	
Ultimate traffic signal (L3)	$0.5 - $1.5 million

6.0 PREFERRED ALTERNATIVE SELECTION

An Alternatives Presentation Meeting was held on December 19, 2016 at the Essex Town Offices to discuss the short, medium, and long term options for the Study intersection. The Town Selectboard, Town Engineer, and members of the public were present. Following this meeting and a recommendation from the Town Engineer, it is recommended that the Town move forward with progressive improvements to the intersection with the ultimate goal of installing a signal.

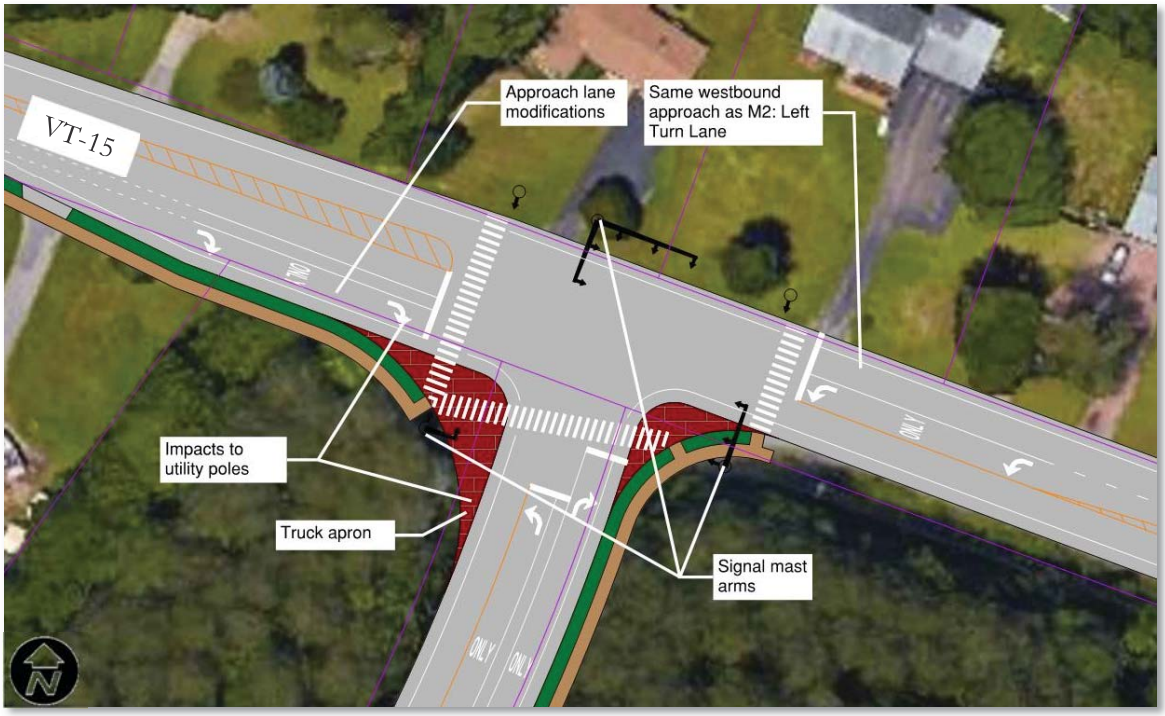
While a roundabout would have several advantages over a signal, a signal will be less expensive, will have less of an impact on front yards and driveways of the residences on the north side of VT-15, and will allow for phased medium-term upgrades that will individually improve traffic operations and eventually support a signalized intersection.

INTERSECTION CONTROL

Although a signal is not currently warranted at the intersection, modeling results indicate greater intersection control will be warranted once currently permitted parcels have been developed and occupied. With the installation of the signal, it would be recommended to upgrade all approaches, including:

- Adding a through eastbound bicycle lane between eastbound through and right turn lanes;
- Widening the eastbound right asphalt radius for large truck tracking paths;
- Removing the northbound splitter island; and
- Adding a northbound left turn bicycle lane.

FIGURE 41: ULTIMATE PREFERRED ALTERNATIVE: SIGNALIZED INTERSECTION CONTROL



IMPLEMENTATION

Progressive Improvements

Two short term improvements are recommended at the intersection:

- **Conduct speed study (Alternative S2):** A speed study would inform whether to reduce the speed limit surrounding the intersection from 40 mph to 35 mph. The results would be valid with a signal in place.
- **Stripe hatched shoulder (Alternative S3):** Striping the area between the edge of travel way and the north edge of the splitter island would allow the northbound stop bars to be moved closer to the through lane, allowing greater sight distance to left-turning vehicles and a longer storage lane, which would reduce the delay of right-turning vehicles waiting behind delayed left-turning vehicles. However, the hatching (and island) will be removed with the installation of a signal.

Several medium term improvements are recommended to be designed and installed with consideration towards the final intersection signal controls:

- **Extend splitter island (Alternative M1):** Extending the splitter island would clarify where northbound drivers are expected to stop and creates more green space. However, the cost to benefit ratio of this option should be carefully considered, given that it would be removed with the installation of a signal.
- **Westbound left turn lane (Alternative M2):** A westbound left turn lane is currently warranted at the Study intersection. It is recommended that its storage be designed to accommodate the signal storage requirements.
- **Extend northbound turn lanes (Alternative M4):** Longer storage space for northbound turns would reduce delays for northbound right turning vehicles in the existing intersection geometry. It is recommended that its storage be designed to accommodate the signal storage requirements.
- **Widen southwest corner radius (Alternative M5):** Widening the eastbound right turn radius would give trucks more room to turn onto Allen Martin Drive. This change would a) reduce obstructions between eastbound right-turning traffic and eastbound through traffic, and b) allow the northbound stop bar to be placed closer to the eastbound through lane to improve sight distance. A mountable curb or grooved asphalt is recommended to discourage use by passenger vehicles.
- **Flashing intersection warning beacon (Alternative M6):** A flashing beacon would alert motorists of the potential for conflicting traffic patterns in advance of the intersection. If installed, the placement of the poles supporting the span wire should be designed to support the mast arms of a traffic signal.

The ultimate signal design will require the relocation of several utility poles and likely Right-of-Way impacts. As development progresses within the Saxon Hill Industrial Park, it is recommended that the ROW is acquired for public use, including the necessary Rights-of-Way for the impacted utility pole.

Funding through Impact Fees

A signal will be warranted when 80 acres of currently undeveloped/unoccupied land within the SHIP is developed and occupied (see Technical Memo #2: Traffic Analysis). The total cost of a signal, including the medium-term improvements, is approximately $1.5 million. The impact fee per acre of development can be determined by dividing this cost by the 80 acres that will lead to a signal being warranted. This results in a fee of $18,750 per acre.

CHANGEABLE MESSAGE SIGN

The Town has shown interest in a permanent installation of a Changeable Message Sign (CMS) directed towards westbound motorists approaching Allen Martin Drive along VT-15. The CMS is generally anticipated to alert motorists of two common transportation scenarios: closure of North Williston Road due to flooding; or congestion due to a crash or incident in Essex Junction. The CMS may also display safety messages, transportation-related messages, emergency homeland security messages, and America's Missing: Broadcast Emergency Response (AMBER) alert messages.

The Agency of Transportation requires that any long term installations of a Variable Message Sign is inside the state highway Right-of-Way, and outside of the roadway clear zone (14 to 24 feet offset from the edge of travel way depending on side slope conditions, and assuming the sign is located in the 50 mph speed zone). If the sign is located inside of the clear zone, it must be protected by guard rail or traffic barrels.

The Town may seek the Right-of-Way adjacent to the roadway to construct a CMS access and display pad. The Agency of Transportation may be willing to use this location as a staging point for moveable CMS signs, or the Town may invest in a locally controlled and managed CMS. The use and messaging displayed on the CMS shall comply with Section 2L of the Manual on Uniform Traffic Control Devices (MUTCD), and it is recommended that the Town develop and establish a policy regarding the types of message and display provided in accordance with the MUTCD.